PRACTIX 100 PLUS

SERVICE MANUAL

Practix 100 plus
PMS 12NC: 9890-010-81791
Date:

Service manual
PMS 12NC: 4512-984-22741
File name: W3000_Rev1.doc

1.Technical data & labels
code: W3004_Rev0

2. Installation & Acceptance
code: W3006_Rev0

3. Replacement
code: W3010_Rev0

4. Adjustments
code: W3012_Rev0

5. Faults finding
code: W3014_Rev0

6. Service information
code:W3016_Rev0

7. Parts list
code: W3018_Rev1 ****

8. Electrical drawings
code: W3020_Rev0

9. Programmed maintenance
code: W3022_Rev0

PRACTIX 100 PLUS

TECHNICAL DATA & LABELS

[File: W3004_Rev0.doc]

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TECHNICAL DATA

Electrical characteristics

Description	Data
Voltage	115/230Vac ±10% Standard monophase with automatic unit predisposition in function of the mains line
Frequency	50/60Hz standard
Absorbed current	9A max. peak in radiography @ 230Vac
Line compensation	Automatic
Line resistance	<1Ω @230Vac < 1Ω @115Vac
Standard plug	16A @230Vac
Classification	Class I, applied parts type B
Use conditions	Continuos functioning with intermitting load
The unit is not suitable to the use where danger of mixtures inflammable with air or nitrous oxide exists.	

Radiological characteristics

Description	Data			
Generator power in DC current	11kW @100Kv			
Inverter frequency	20kHz			
Max. Ripple	<1% @100kV			
Rise time	<2ms @100kV			
kV Range	40 ÷ 125kVp in step of 1kV			
mA range @115/230Vac	kV	mA		
		mAs>0,63		mAs<0,63
		(t<100ms) MODE1	(t>100ms) MODE2	MODE2
	40	140mA	70mA	70mA
	50	140mA	70mA	70mA
	60	130mA	65mA	65mA
	70	125mA	63mA	63mA
	80	120mA	60mA	60mA
	90	115mA	58mA	58mA
	100	110mA	55mA	55mA
	110	90mA	45mA	45mA
	120	80mA	40mA	40mA
	125	75mA	38mA	38mA
mAs range in function of kV @115/230Vac	**0,2 ÷ 125mAs in 57 steps with 12,5% inc.**			
	From:	40 ÷ 42kV	0,2 ÷ 125mAs	
		43 ÷ 62kV	0,2 ÷ 100mAs	
		63 ÷ 72kV	0,2 ÷ 80mAs	
		73 ÷ 102kV	0,2 ÷ 63mAs	
		103 ÷ 125kV	0,2 ÷ 50mAs	

Monobloc

Description	Data
Monobloc type	MHF 2011
Weight	19kg.
X-ray tube type	IAE X20P
Anode	Rotating (2850rpm @ 50Hz) (3400rpm @ 60Hz)
Focus nominal extension according to IEC 336	0.8mm small focus
Nominal anodic power (for 1 sec.)	11kW small focus
Anode thermal capacity	50kJ (67kHU)
Anode disk diameter	64mm
Anode inclination	17,5°
Max. continuos thermal dissipation of the anode	175W
Max. anode cooling speed	13kJ/min (17,5kHU/min)
Monobloc thermal capacity	600kJ (800kHU)
Max. continuos thermal dissipation of monobloc	55W
Total filtration	2.7mm Al
Leakage radiation	<1mGy/h second IEC 601-1-3
Loading, heating, and cooling curves	Please refer to the enclosed diagrams
H.V. transformer isolation	Oil bath

Collimator

Description	Data
Type, brand and model	Manual with internal luminous source (Ralco P 232)
Collimation	Square field, multilayers
Brightness source	Halogen lamp 12V 100W with temporized ignition of approx. 30s
Field covering	43 x 43cm at focus film distance of 1m
Brightness intensity	160lux at focus film distance of 1m
Contrast ratio	4:1
Focus film distance measure	Extractable Meter
Inherent filtration	2mm Al
Rotation	±130°
Weight	8.4Kg.
Accessories	Predisposition of the ionization chamber insertion

Environmental data

Description	Normal use	Transport and warehouse
Temperature	From +10°C to +40°C	From -25°C to +70°C
Relative humidity	From 30% to 75% not condensing	From 10% to 90% not condensing
Pressure	From 700 to 1060hPa	From 500 to 1060hPa

Operative modes

Mode	Characteristic	Performances
Radiography	Working Mode	At 2 points with kV and mAs setting
	APR Anatomic Mode	Memorization of 32 exams, (4 programs, each of 8 exam) available in the 4 selectable languages
	Small focus in any operating status	0,8mm
	kV variation range	40 ÷ 125kV in step of 1kV
	mA variation range @115/230Vac	38 ÷ 140mA associated in automatic to kV
	mAs variation range @115/230Vac	0,2 ÷ 125mAs in 57 steps with 12,5% increases
	Times range @115/230Vac	0,0025 ÷ 2s in function of the set mAs
	Exposure control	Constant kV and mA during the whole exposure
	Use coefficient (duty cycle)	1:40

Functionality

Description	Data
User's interface	Keyboard with display (alphanumeric LCD, 4 lines x 20 characters) for every operating parameter and message of eventual anomalies. Service program for faults finding. Microcontroller management.
Selectable languages	English, French, German and Spanish, by a configuration program.
Radiography control	Push-button with extractendible cable. It's shown the use of last kV value set in manual mode or APR. Upon the ignition the unit is set in manual mode with default values.
Safeties	Filament current. Monobloc temperature. Max. load exceeded. Max. kV or H.V. fault. Memory data check. Microcontroller auto test

Accessories and options

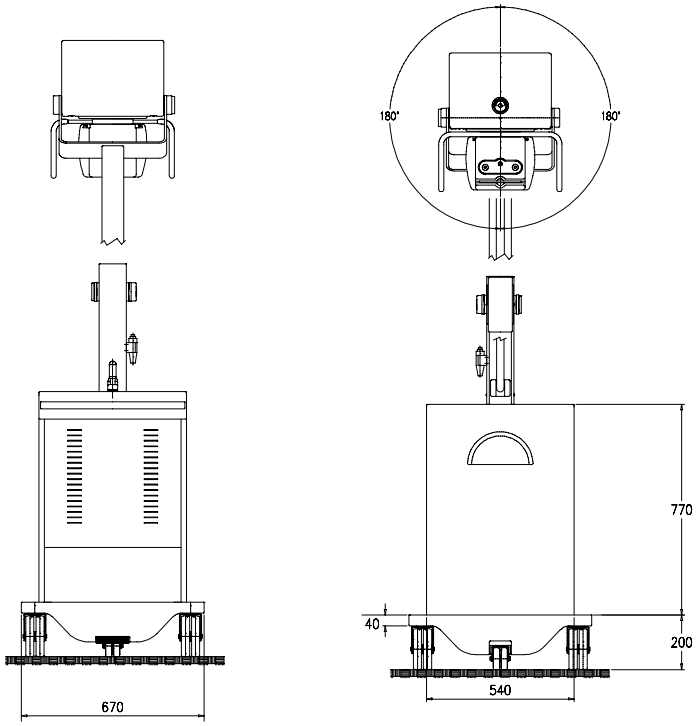
Description	12NC	
X-ray control with extendible cable	4512-535-39761	Standard
Infrared X-ray control, model RAYMOTE III	9890-010-82071	Optional
Ionizing chamber dosimeter, model DIAMENTOR PX	9890-010-81141	Optional

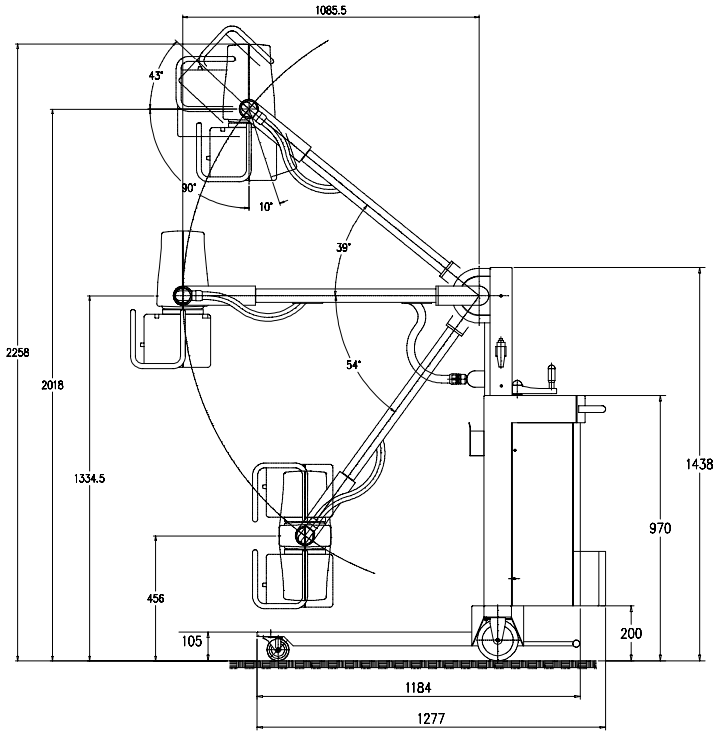
Mechanical characteristics

Description	Data
Weight	170kg approx.
Max. width	670mm
Length in transport position	1277mm
Max. height in transport position	1438mm
Max. height with arm at the max. extension	2258mm
Control console height	970mm
Focus-floor distance	456 ÷ 2018mm
Arm rotation around the vertical axis	n.d.
Monobloc rotation around the arm axis	±180°
Monobloc rotation around its axis	153° (+104° ÷ -49° towards the vertical axis)
Max. height of the unit front leg	105mm
Cassette holder	5 cassettes, 35 x 43cm format
Movement	Manual. Double front swiveling wheel. Double rear wheels driven by the handle placed on the unit stand near the console. Stationary brake activation by the same handle for the rear wheels driving. Tilting pedal (obstacles over passing).
Wheels diameter	Rear: double wheel 150mm width 30mm Front: double wheel 80mm width 25mm

Please refer to the drawing enclosed

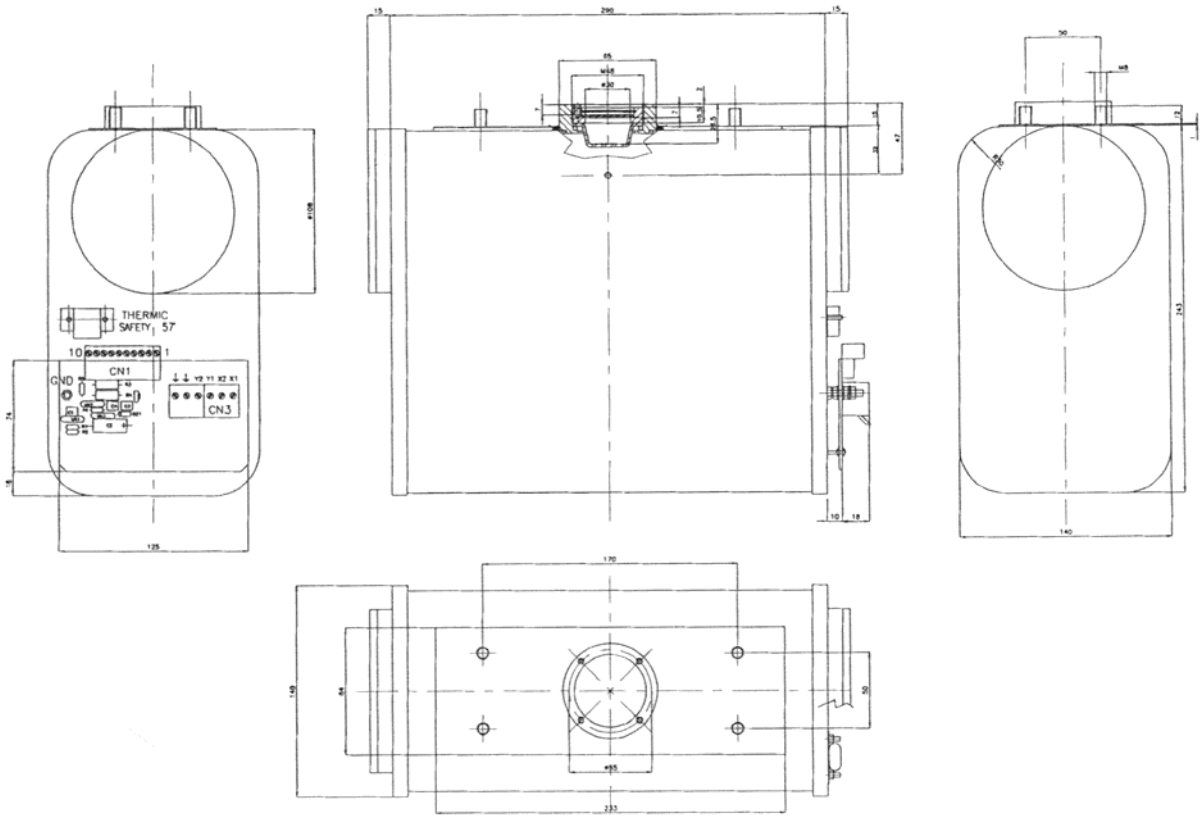
Unit volume sizes





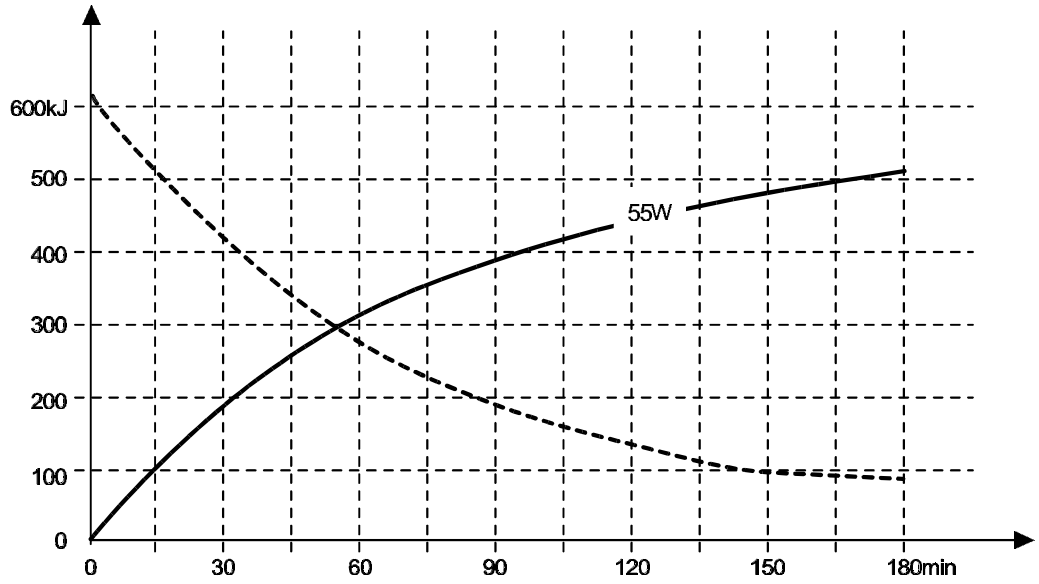
MHF 2011 Monobloc

Sizes



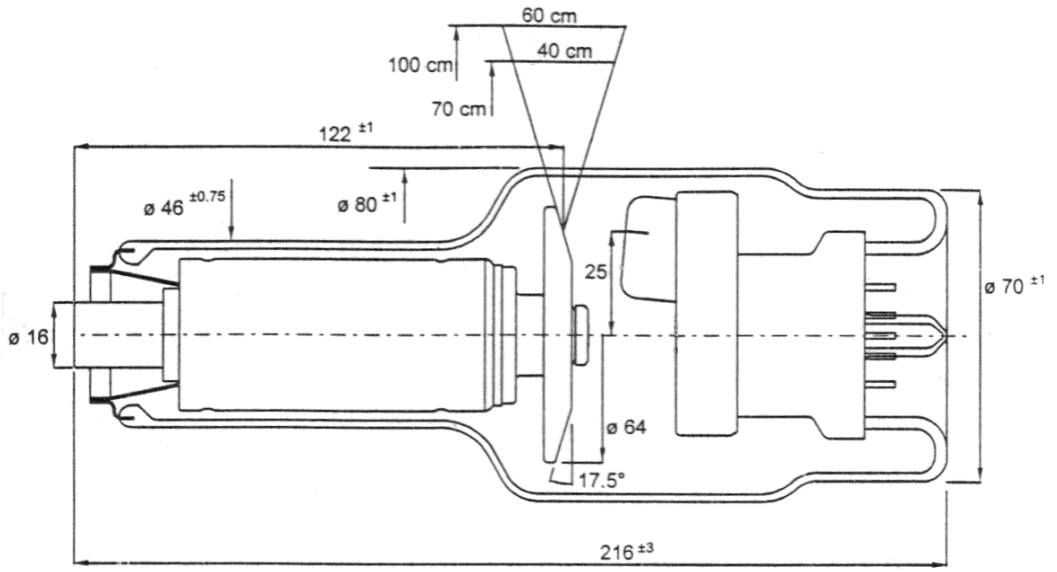
Monobloc cooling and heating curves

Stored energy (kJ) / Time (min)



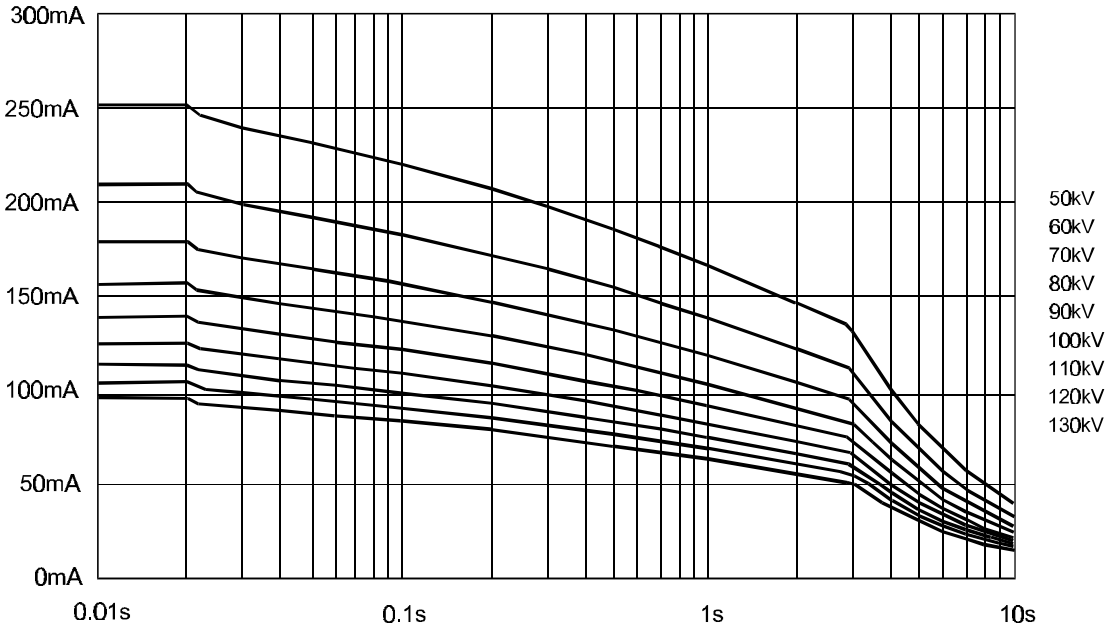
Tube characteristics

Sizes



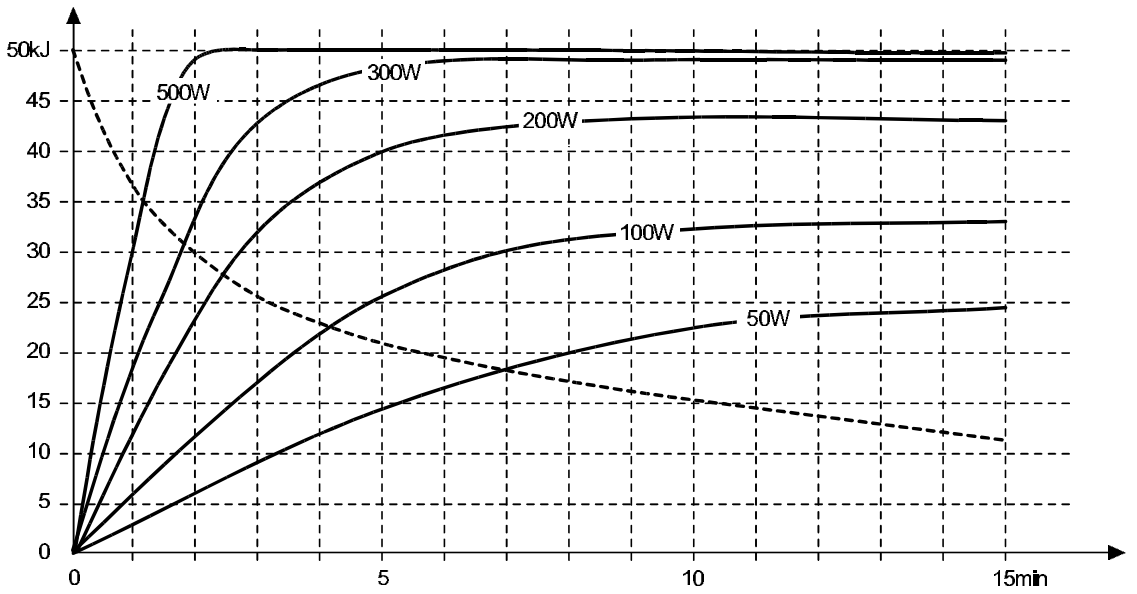
Single load rating
0.8 - 3~ - 3000min^{-1}

Tube current (mA) / Time. (sec)



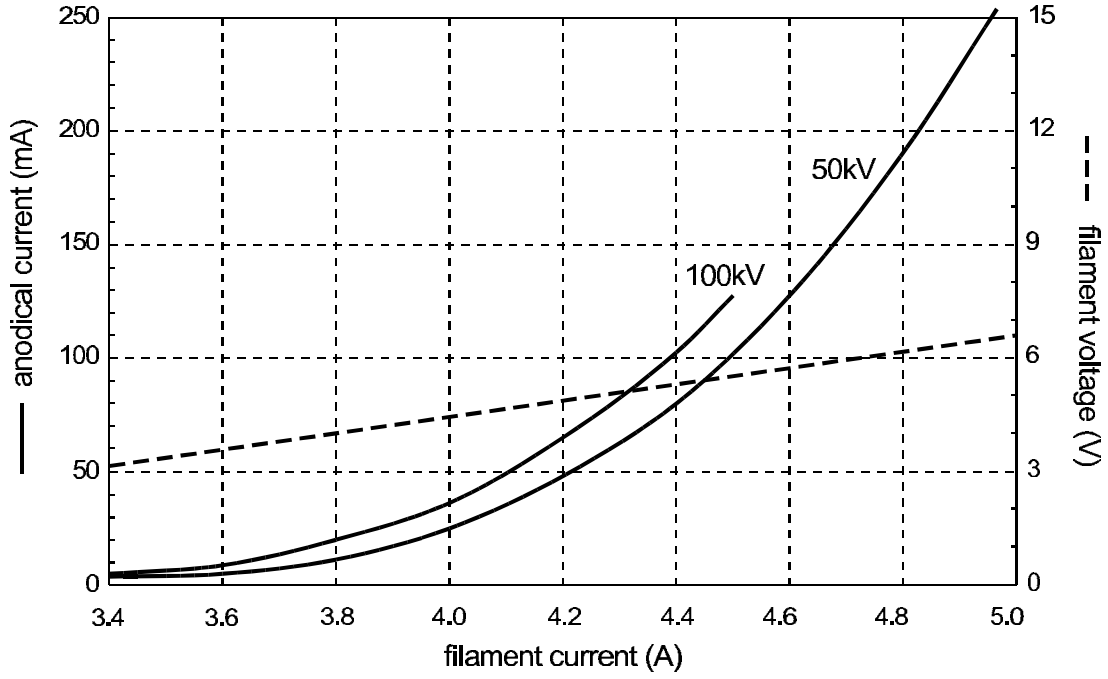
Anodical cooling and warming curves

Stored energy (kJ) / Time (min)

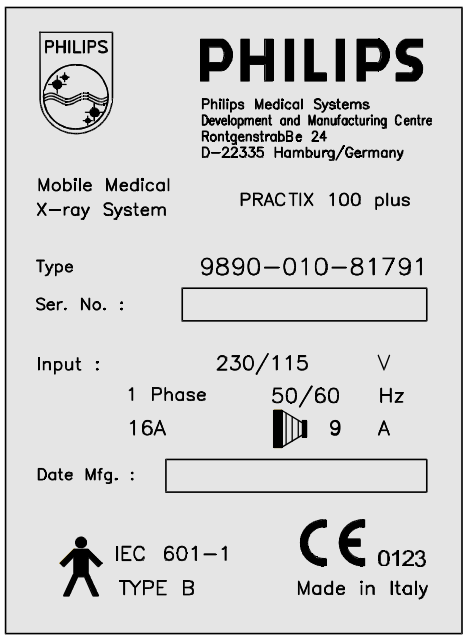


Filament emission curve

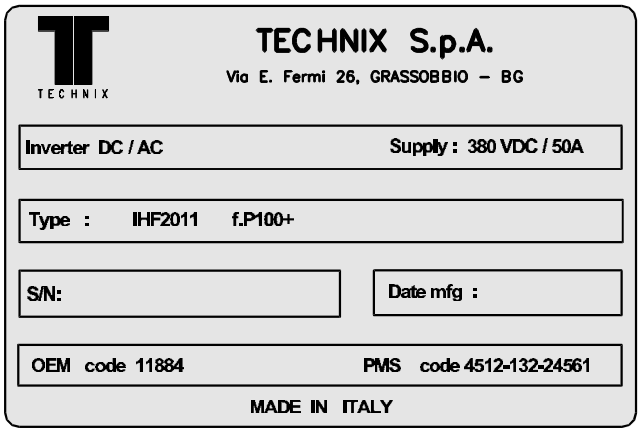
Filament current / Anodical current (mA)
Filament current / Filament voltage (V)



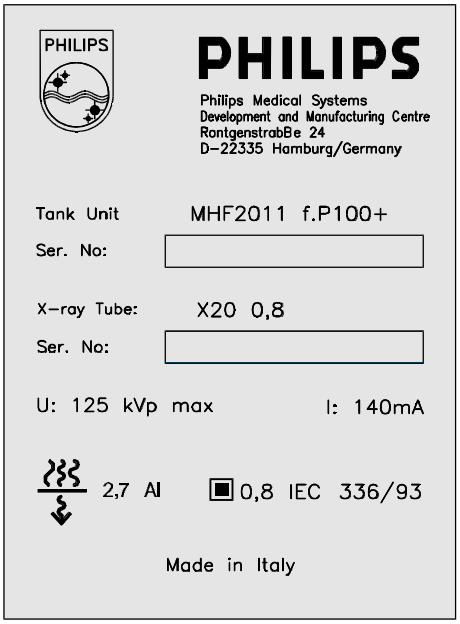
LABELS



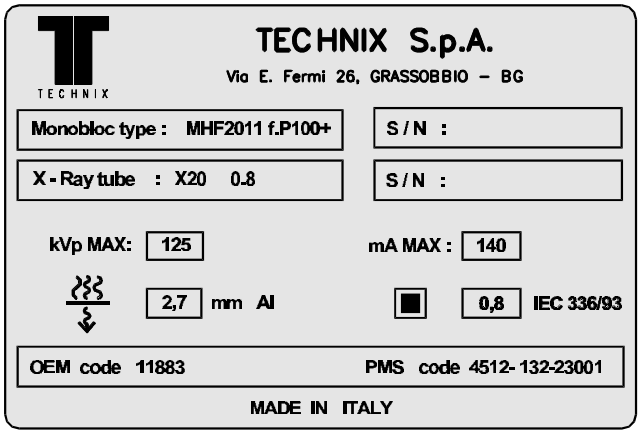
unit label



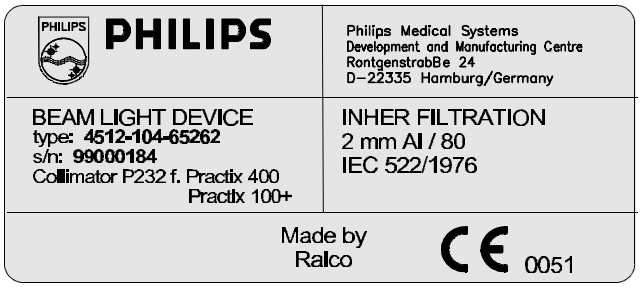
inverter label



monobloc external label



monobloc internal label



collimator label

STANDARDS AND DIRECTIVES COMPLIANCE

Reference	Description
MDD 93/42/EEC	Medical Devices Directive (CE mark)
89/336/EEC	Electromagnetic compatibility
EN IEC 60601-1	Medical devices safety
EN IEC 60601-1-2	Electromagnetic compatibility
EN IEC 60601-1-3	Protection against ionizing radiation
EN IEC 60601-1-4	Software safety
EN IEC 60601-2-7	High voltage generators
EN IEC 60601-2-28	X-ray tube assemblies – housing
EN 1441	Risk analysis
IEC 336	X-ray tubes focus
UL 187	USA standard
FDA	USA standard
CDHR	USA standard
CSA	Canada standard

DOCUMENT STATUS

Rev.	*Date*	*Page/s*	*Modifiction description*
0			Document approval
1			
2			
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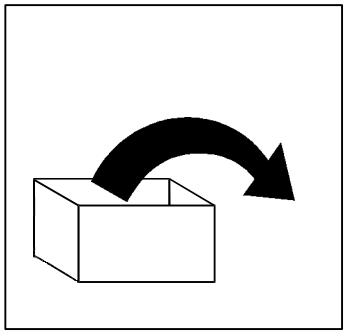
PRACTIX 100 PLUS

INSTALLATION & ACCEPTANCE



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HOW TO PROCEED

For the proper and safe unit installation please follow, step by step, the INSTALLATION SHEET. Proceed with the next operation ONLY once the previous steps have been properly completed.

INSTALLATION SHEET	
1. Preliminary knowledges and information	❑ yes ❑ no
2. Unpacking and content verification	❑ yes ❑ no
3. Sight check of the unit integrity *	❑ yes ❑ no
4. Reading of the chapter “Service information”	❑ yes ❑ no
5. Mechanical tests*	❑ yes ❑ no
6. Check of the unit compatibility with mains	❑ yes ❑ no
7. Electrical tests (do not perform x-ray)*	❑ yes ❑ no
8. X-ray tube preparation*	❑ yes ❑ no
9. X-ray tests*	❑ yes ❑ no
10. Request of data configuration to the user	❑ yes ❑ no
11. Unit configuration	❑ yes ❑ no
12. Now the unit is ready for the use	☺ !!EUREKA!!

* Acceptance phase

PRELIMINARY INFORMATION

This unit has been assembled and checked in factory following methods certified both for production and testing. The same methods are in compliance with the most recent international Standards and with the European Directive for Medical Devices (93/42 CEE).

During checking phase it is draught a Test Report including the following information is draught:

- Output data accuracy (kV-mA-time) test
- Light field X-ray field conformity test
- Electrical safety (PE resistance and leaked currents)

To ensure the unit safety and efficiency even during the transport between firm and user, some tests and functional checks are required. It is necessary to perform those tests upon installation.

To check the output data, therefore kV and X-ray time measurements, the use of non-invasive tools is required. Should tools be not available, check these values on the unit display directly (see next pages).

Perform what described in this chapter, even if additional and specific acceptance tests are required (i.e. by hospital or Government).

DO NOT PERFORM HAZARDOUS OPERATIONS ELECTICAL SHOCK DANGER

Even if the mains plug is disconnected a dangerous voltage can be present inside the unit in case the capacitors battery is not completely discharged.

PERFORM THE DISCHARGE PROCEDURE

Before removing the Plexiglas protection or performing any operation on Capacitors Battery, Power Unit, Inverter Power Circuits and Monobloc it is necessary to discharge the capacitors battery.

THE DISCHARGE PROCEDURE IS DESCRIBED IN THE CHAPTER "Faults finding".

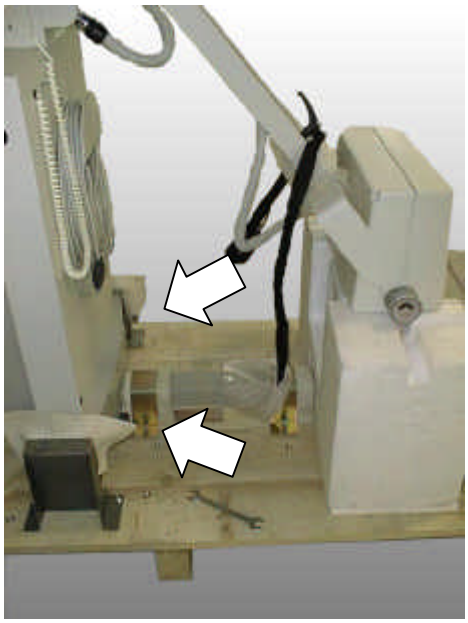
UNIT UNPACKING

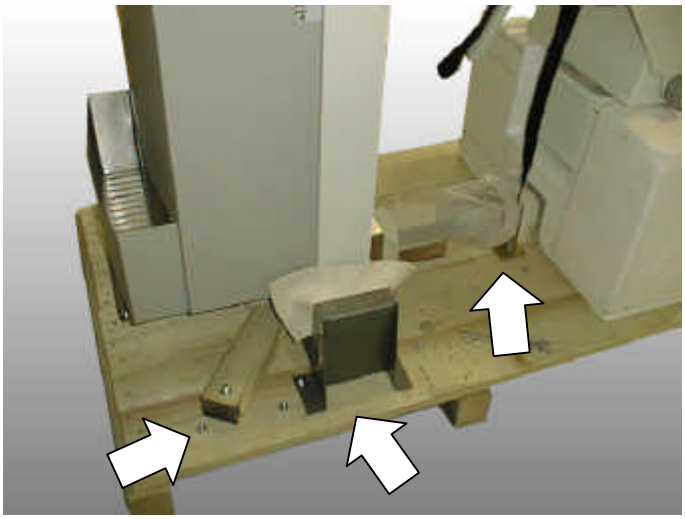
Unpacking procedure

This procedure requires **a two operators intervention**. For its performance, it is necessary to use a fork key ø17mm to remove clamps and a screwdriver to remove the packing screws.

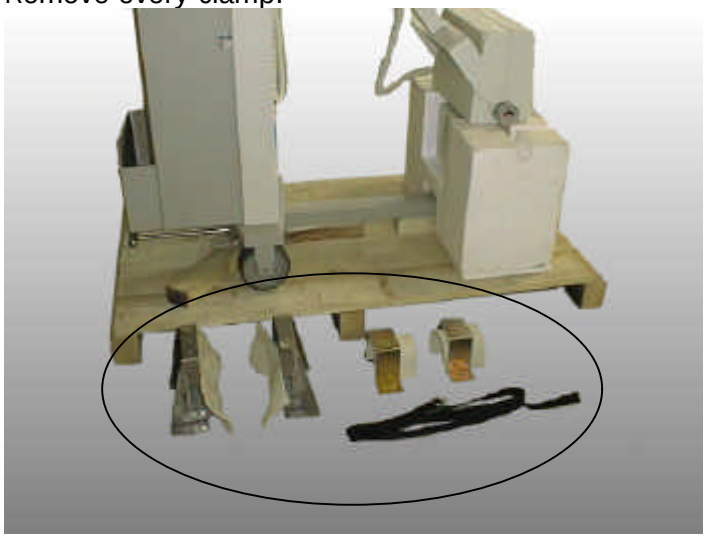
1. Remove the packing cover.

2. Loosen the nuts which fix the clamps and remove the arm belt.

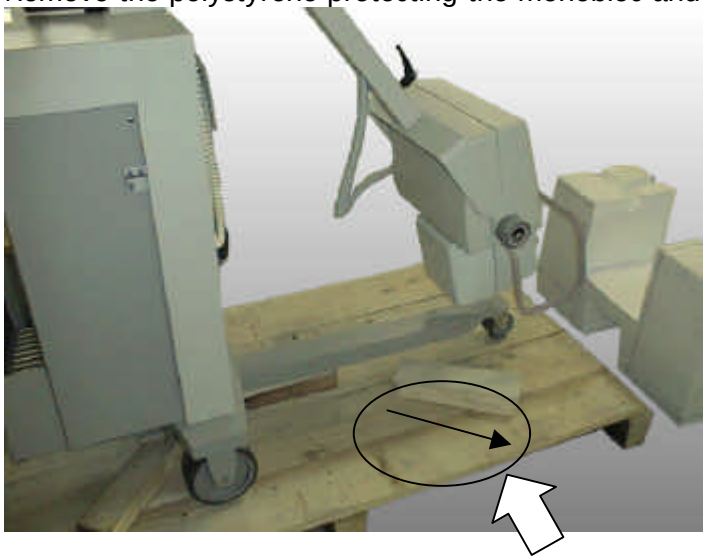




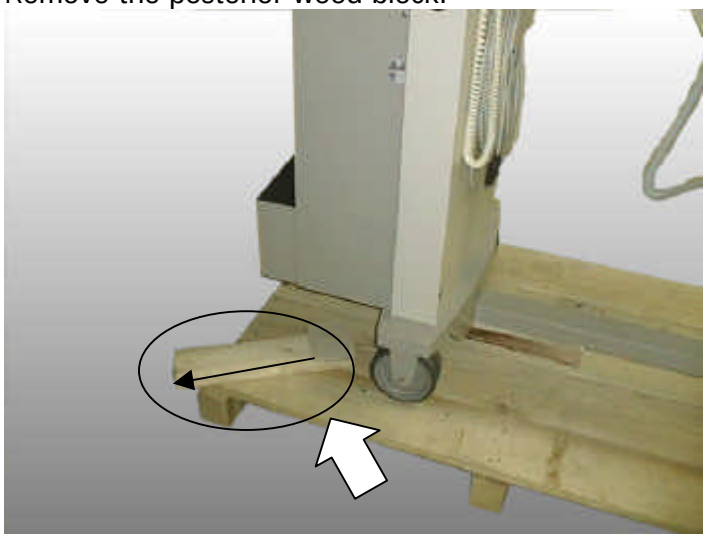
3. Remove every clamp.



4. Remove the polystyrene protecting the monobloc and the anterior wood block .

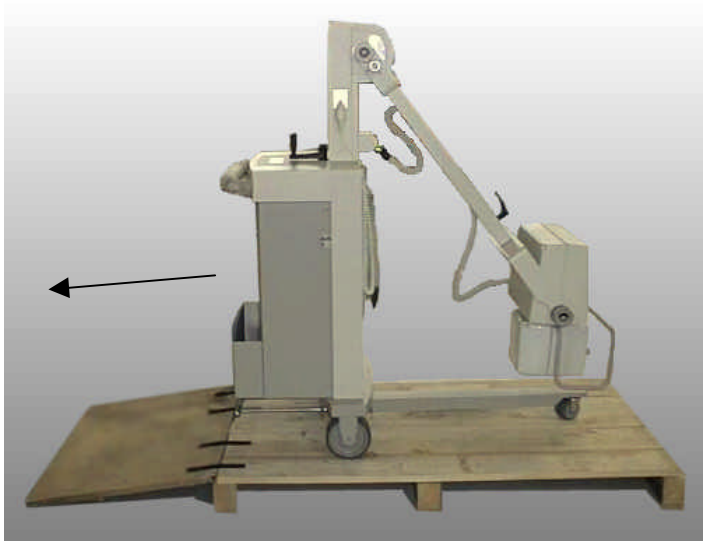


5. Remove the posterior wood block.



6. Act on the tilting lever and arise the unit frontal part, remove the central wood block.

7. Then, by using the skid, operate very carefully and remove the unit from the pallet.



Packing and content description

The packing includes:

q.ty	description	TX cod.	12NC
1	PRACTIX 100 plus	62915	9890-010-81791

Manuals			
1	User's manual in English language		4512-109-23042
1	User's manual in German language		4512-109-23041
1	User's manual in French language		4512-109-23043
1	User's manual in Spanish language		4512-109-23044
1	Service manual (english)	X3000	4512-984-22741

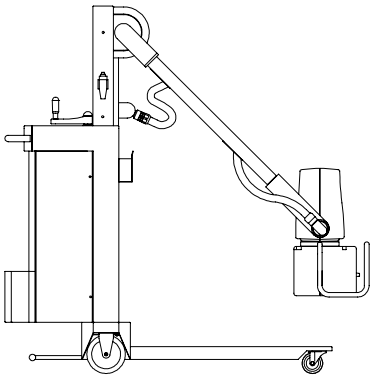
Paints			
1	Touch kit paints composed by:	62428	4512-535-39211
	1 Gray SF8758 1 Pink SF8582 1 Mushroom SF6998		

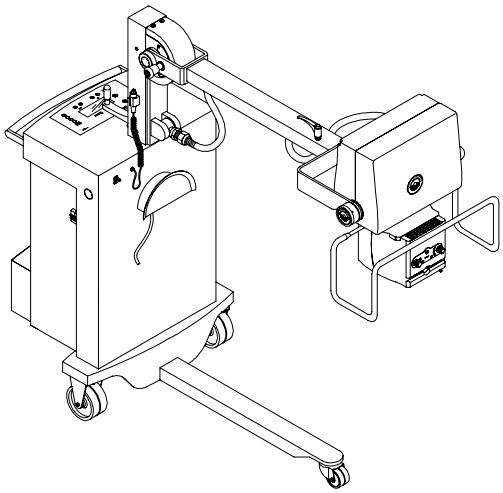
Parts			
1	Spare parts set composed by:	62918	4512-132-23131
	1 Halogen lamp 12V - 100W	11449	4512-535-38731
	1 Fuse 5x20 T 250mA / 250V	11361	4512-132-23141
	1 Fuse 5x20 T 500mA / 250V	11288	4512-535-37301
	1 Fuse 5x20 T 1A / 250V	11289	4512-535-37291
	2 Fuse 5x20 T 4A / 250V	11292	4512-535-37331
	1 Fuse 5x20 T 10A / 250V	11150	4512-535-37271
	2 Ceramic extrafast fuse 10x38 20A - gR/ 600V	11917	4512-132-23151
	2 Extrafast fuse 63A - ETF / 660V	11456	4512-132-23161
	4 Support for board locking EHCBS - 6 (h=10mm)	11872	4512-132-24361
	2 Support for board locking EHCBS - 16 (h=25mm)	11867	4512-132-23181
	4 Cables medium clip 150x3,6mm	11234	4512-535-23191

SIGHT CHECK OF THE UNIT INTEGRITY

After the unpacking phase perform the following checks:

1. Labels
2. Covers painting
3. Keyboard
4. Collimator and monobloc
5. Handles
6. Mains cable
7. X-ray button and button cable
8. Generator-monobloc-collimator connecting cable



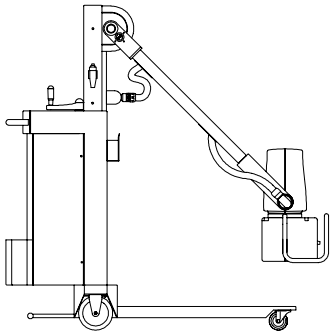


PRELIMINARY KNOWLEDGES

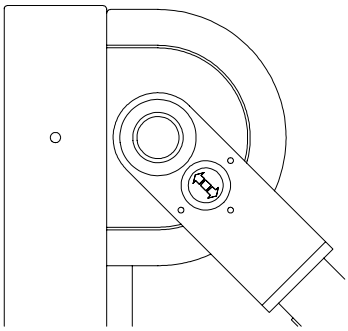
Before proceeding with the unit installation **the technician has to carefully read the chapter "Service information."** It includes several useful information to perform the installation properly.

MECHANICAL TESTS

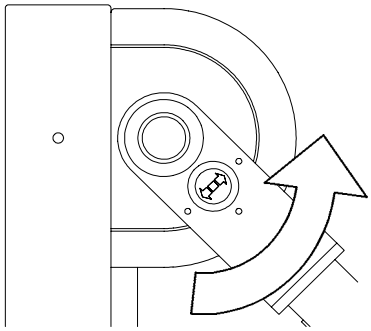
1. Move the unit from the parking condition (unlock the arm) by pulling and rotating (90°.) the release pawl.



parking position

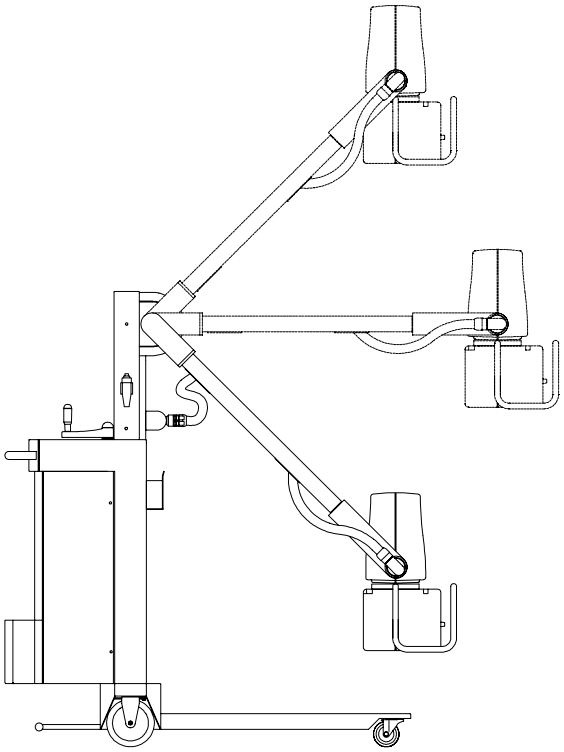


locked arm

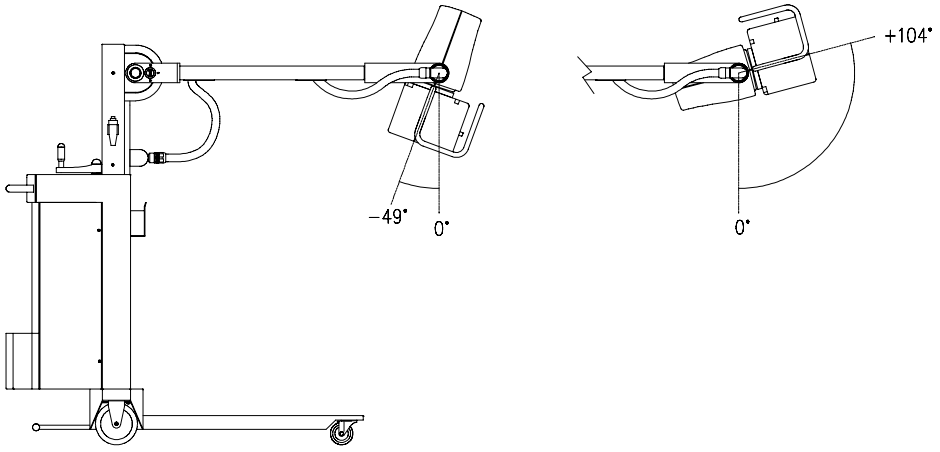


unlocked arm

2. Check the arm movement and balancing in every operative position, as shown in the picture.



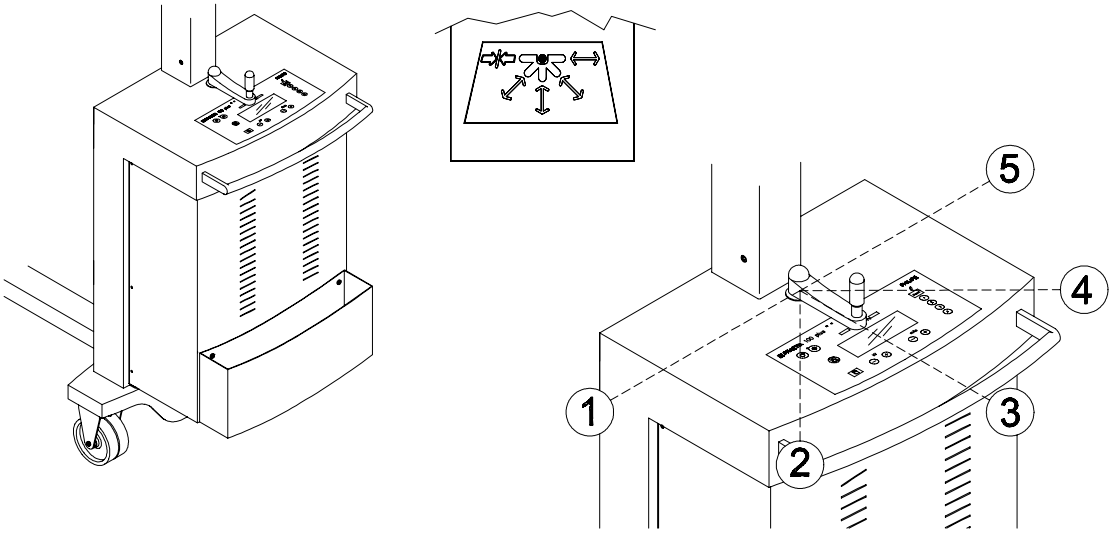
3. Check the monobloc group balancing and rotation towards the longitudinal axis.



4. Unlock the monobloc brake and check the monobloc group rotation (±180°) around the horizontal axis. Furthermore check the right gonimeter indication.

5. Check the proper collimator rotation around his vertical axis (±135°).

6. Check the stationary brake and the directional handle.



Place the handle in the following positions (refer to the label attached on the arm column) and check the proper functioning:

- pos. 1: brake ON
- pos. 2: oblique left-right motion
- pos. 3: backward-forward motion
- pos. 4: oblique right-left motion
- pos. 5: left-right motion

UNIT SUPPLY

Preliminary operations

The Practix 100 plus automatically adapts to the mains.
The unit performances do not depend on mains voltage (115V or 230V).
Only the anode starting time and, as a consequence, the preparation time, depend on the mains voltage (0,8s @230Vac - 1,6s @115Vac). These parameters are automatically set by the unit.

Before connecting the unit to the mains check the following:

1. mains voltage.....115V or 230V (±10%) monophase
2. mains frequency.....50Hz or 60Hz
3. available power .....3kW (16A max)
4. mains plug with earth connection

Before connecting the mains make sure that the PLUG IS GROUNDED.

Mains connection

Then it's possible to connect the unit to the mains.
The mains voltage presence is indicated by the turning ON of the yellow led placed aside the ON button. Should the led be OFF, make sure that the automatic switch is turned ON.

ELECTRICAL TESTS (NO IRRADIATION)

Never perform an exposure in this phase. It may be dangerous for the unit integrity.

Ignition - Start up - Ready

1. Turn the unit ON (press the ON button) and follow step by step the Start up sequence, checking its proper performing (refer to chapter “Service information”).
2. If no problem is detected the display will show the message “READY” after the Start up phase.

Collimator check

1. Completely open the collimator blades.
2. Press the COLLIMATOR button located on the keyboard (or on teh same collimator), turn the collimator lamp on and check its proper functioning (approx 30s long).

Data setting and preparation check

1. Verify the functioning of the kV and mAs increase/decrease buttons.
2. Perform X-ray preparation (just press the first step of the button for 3s at least) and check the proper anode rotation.
3. Upon the button release, check the anode proper braking.

TUBE PREPARATION

Warning: X-ray presence, use proper protections.

Arrange the tube for X-ray performing the Warm-up (*Warm* sub-procedure) and the *kVup* sub-procedure (kV step-up). Perform these procedures with the TUBE SEASONING program (refer to SERVICE MODE, chapt. “Service information”).
At Start up, after a long inactivity period (3 months or more) the display will show “TUBE SEASONING” message. Therefore, it’s necessary to proceed with the TUBE SEASONING program (refer to SERVICE MODE, chapt. “Service information”).

After the seasoning DO NOT perform any exposure. Let the monobloc cool down for 8 minutes at least.

ACCURACY TEST

Output data check

Warning: X-ray presence, use proper protections.

Place in the X-ray field a non-invasive tool for the kV and X-ray time measurements according to what indicated in the tool manual.

Perform the exposures listed in this table and verify that the measured values are in the allowed limits.

Set data output		Theorical time	Measured value		Acceptance limit data output	
kV	mAs	[ms]	kV	time [ms]	kV	time [ms]
60	12,5	96	.....	.....	57 - 63	91 - 101
80	12,5	104	.....	.....	76 - 84	98 -109
80	63	950	.....	.....	76 - 84	902 - 998
100	11	100	.....	.....	95 -105	95 - 105

Without the tool:

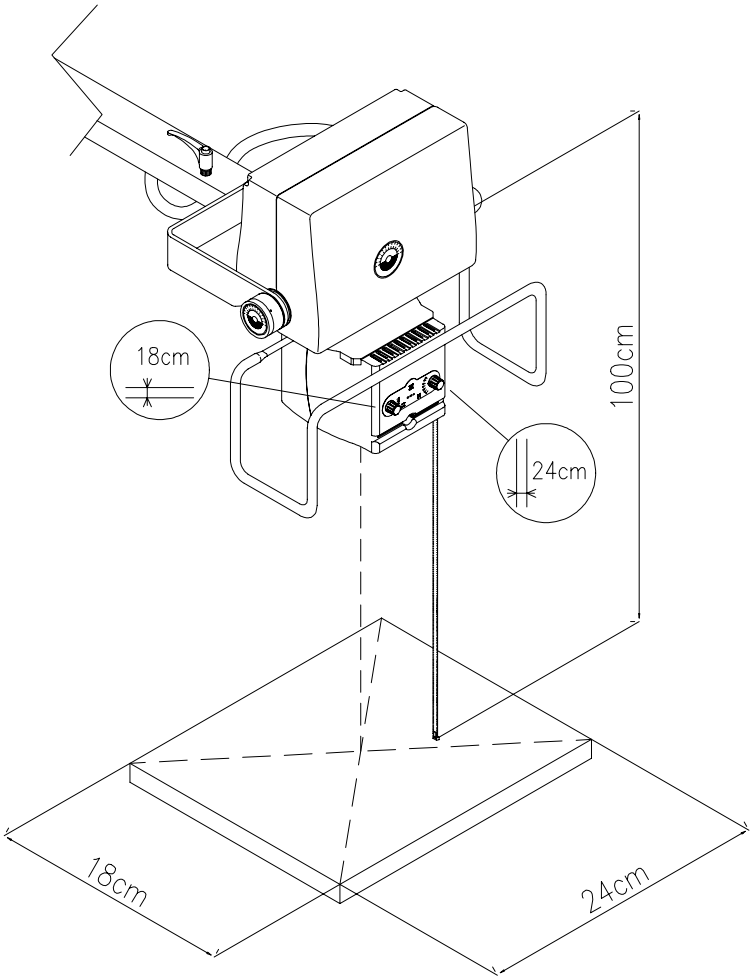
- it's possible to check the X-ray time on the unit display directly; this is automatically displayed after every exposure;
- it's possible to check the kV (and anodic current) from the SERVICE MODE, by the TEST KV-mA option, as described in the chapter "Service information ".

X-ray irradiation field check

Warning: X-ray presence, use proper protections.

This test verifies the correspondence between collimator light and X-ray field.

1. Place under the collimator, at 1m from the focus, a 18x24 cassette with film.



2. Press the COLLIMATOR button (both on collimator and keyboard); the lamp will be ON for approx. 30s.

3. Rotate the handles placed on the collimator and adjust the shutters opening, in order to light the whole surface of the cassette.

4. Perform an exposure (i.e. 63kV/10mAs) and check the proper irradiaton of the film (at least within the requested tolerance).

The X-ray data/parameters vary in function of the cassette type.
As alternative to the cassette it's possible to use a fluorescent, graduated, high persistence screen (field position analyzer).

UNIT CONFIGURATION

Default configuration

The unit has been set as follows:

PARAMETER	DEFAULT	DISPLAY
Maximum kV (MAX. KV)	125kV	125
Start up kV (START KV)	63kV	63
Start up mAs (START mAs)	4mAs	4
Language (LANGUAGE)	English	ENG
APR data storing (APR mem.)	disenabled	OFF
Starter brake (SARTER BRAKE)	enabled	ON
Dosimeter (DOSIMETER)	not present	OFF
Buzzer (BUZZER)	enabled	ON
Date and time (DATE-TIME)	Rome time zone (GMT+1.00h)	

Customer's configuration

The user has to be aware of the different working possibilities of the unit, thus to choose the most convenient and suitable configuration.
Before proceeding it is necessary to fill out, together with the user, the CONFIGURATION SHEET (see the next page).

Configuration sheet

Unit: PRACTIX 100 plus	s/n°:
Place of installation:	Date of installation:
Dept:	Date of maintenance:

Maximum kV value. (please, choose between 40 and 125)	.....kV
kV value at start up. (please, choose between 40 and the maximum kV value)	.....kV
mAs value at start up.	.....mAs
Messages language. (choose among English, Spanish, French and German)	.....
Availability to store APR values modified by the operator.	❑ yes ❑ no
Disenablation of the anode braking.	❑ yes ❑ no
Dosimeter presence. (available on request)	❑ yes ❑ no
Disenablation of beeper.	❑ yes ❑ no

User's signature:	Technician's signature:

Configuration

Now it's possible to set the unit with the values indicated in the CONFIGURATION SHEET. By SERVICE MODE activate the CONFIG function (see the chapter "Service information") and modify the parameters.
Please note that, with the service technician's intervention, it will be always possible to modify the configuration parameters.

Date and time setting

Set date and time, follow the DATE-TIME procedure (please refer to SEVICE MODE, described in the chapter "Service information").

With the service technician's intervention, it will be always possible to modify the configuration parameters.

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PRACTIX 100 PLUS

REPLACEMENT

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SUMMARY

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PROCEDURES DESCRIPTION

Electrical parts replacement

Should a fault or a malfunctioning be detected, it is advisable to replace the boards (and not to repair them). The boards provided will be already tested and adjusted.
In case of any adjustment, please refer to the chapter “Adjustments”.

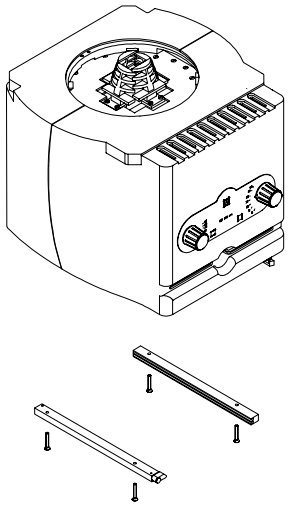
Mechanical parts replacement

Lamp replacement

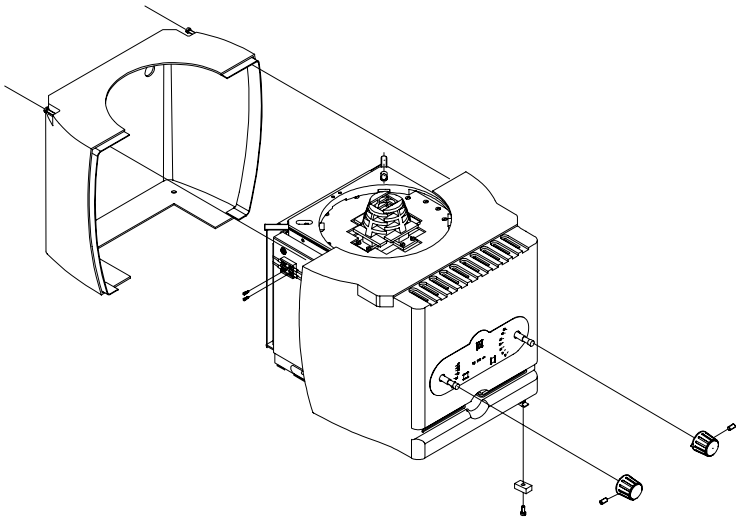
WARNING: Before proceeding make sure of the lamp bracket, lamp and socket cooling. Danger of fingers burning!!.

1. Disconnect the mains.
Block the unit brakes.
Park the arm in the lowered position and activate the safety brake.

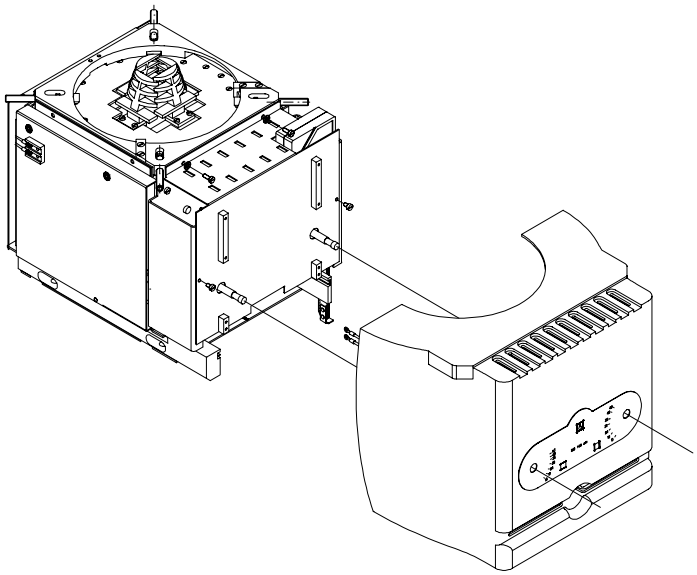
2. Remove the filters holder slides (4 screws).



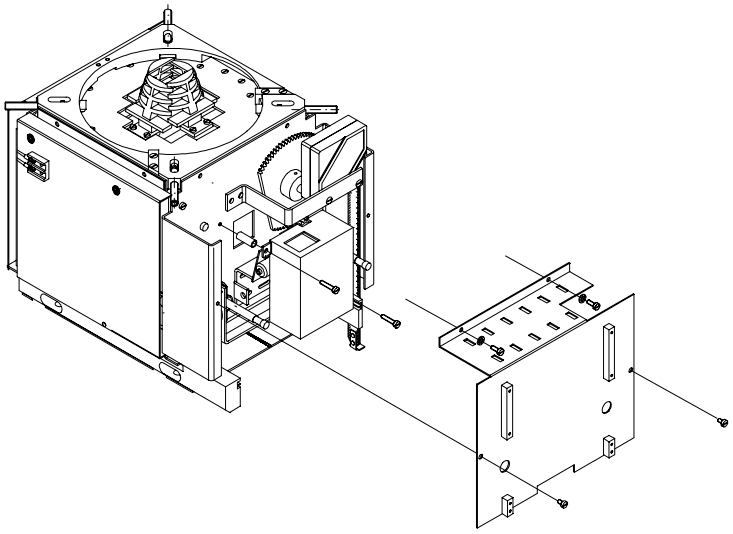
3. Remove the rear cover (2 screws). Pay attention to wires.
Remove the handles (2 hexagonal, ø2mm).
Remove the top of the extractable meter (1 screw).
Disconnect the clamp of the lamp button (2 screws, no polarity) placed on the collimator side.



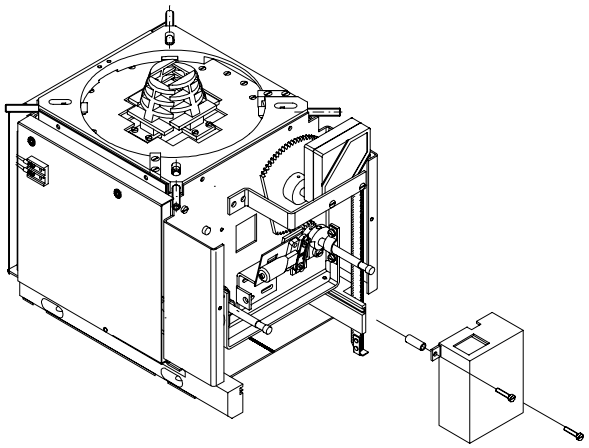
4. Remove the front cover (pay attention not to break the extractable meter).



5. Remove the 4 screws of the front cover (2 long, 2 short).
Remove the second front cover (very carefully, this is not an easy operation).



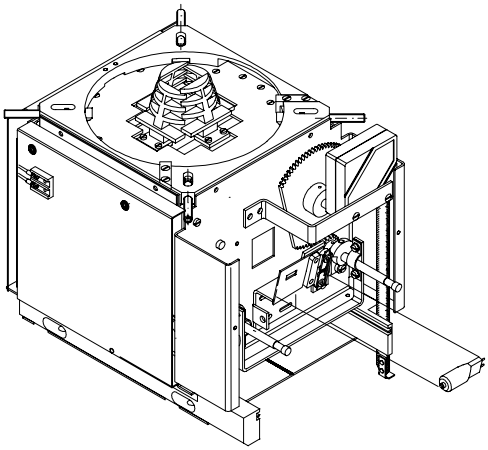
6. Remove the 2 screws and the spacers of the lamp protection cover.



7. Do not touch the lamp, socket or lamp bracket with fingers. These could be very hot and cause severe burns.

EVEN IF COLD, NEVER TOUCH THE LAMP WITH UNPROTECTED HANDS!!
Carefully remove the faulty lamp.
Replace the lamp with a new one type:

PHILIPS PROJECTION LAMP
Type 7023
FCR A1/215
12V 100W GY6.35
cod. 3222 617 51621 or 7222 613 32021
or equivalent



8. Make sure that the lamp pins are completely inserted in the lamp-holder.

9. Follow the foregoing steps from the bottom to re-mount the collimator assembly.

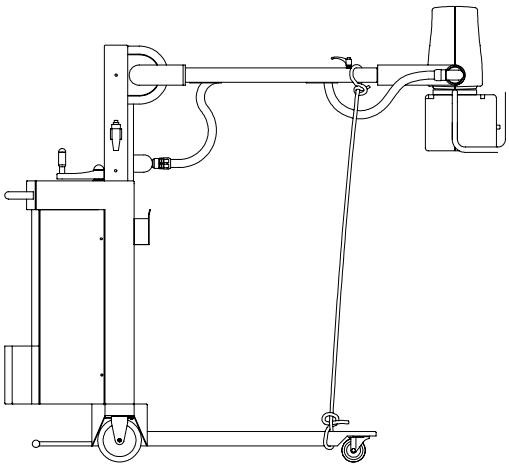
10. Before remounting the handles close both shutters and adjust the handle indicators.

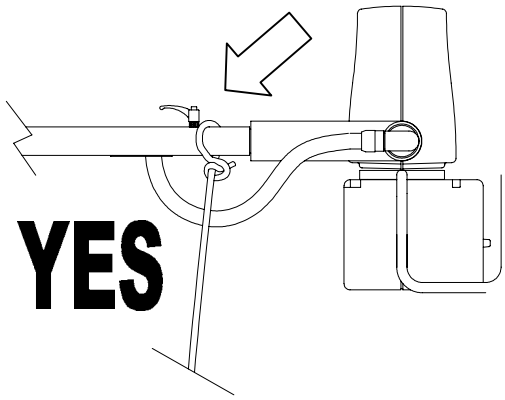
Monobloc replacement

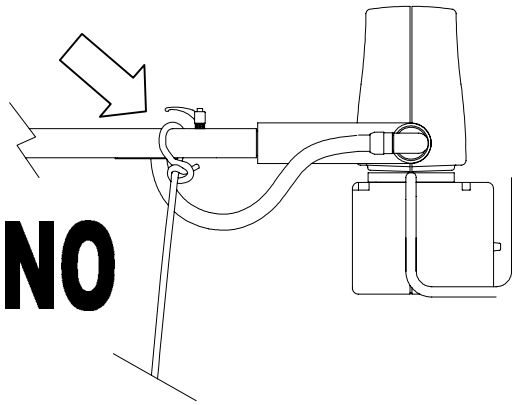
This procedure can cause severe and serious damages to unit and/or operators. Act VERY CAREFULLY while performing any operation.

1. ***How to arrange the unit for the replacement.***
   Disconnect the unit from the mains.
   Block the unit brakes.
   Park the arm in horizontal position.
   Properly stretch a stout belt or a rope **(resisting to 100kgf/1000N at least)** between arm and front leg. Make sure that the rope cannot slide towards the arm pivot. To perform this operation, tightly bind the rope between the blocking handle for the rotation and the monobloc stirrup. Furthermore, check that the rope is well stretched.

   IMPORTANT: When the monobloc is removed from its support, a force at the arm extremity directed to the top, will be present (of approx. 40kgf/400N).

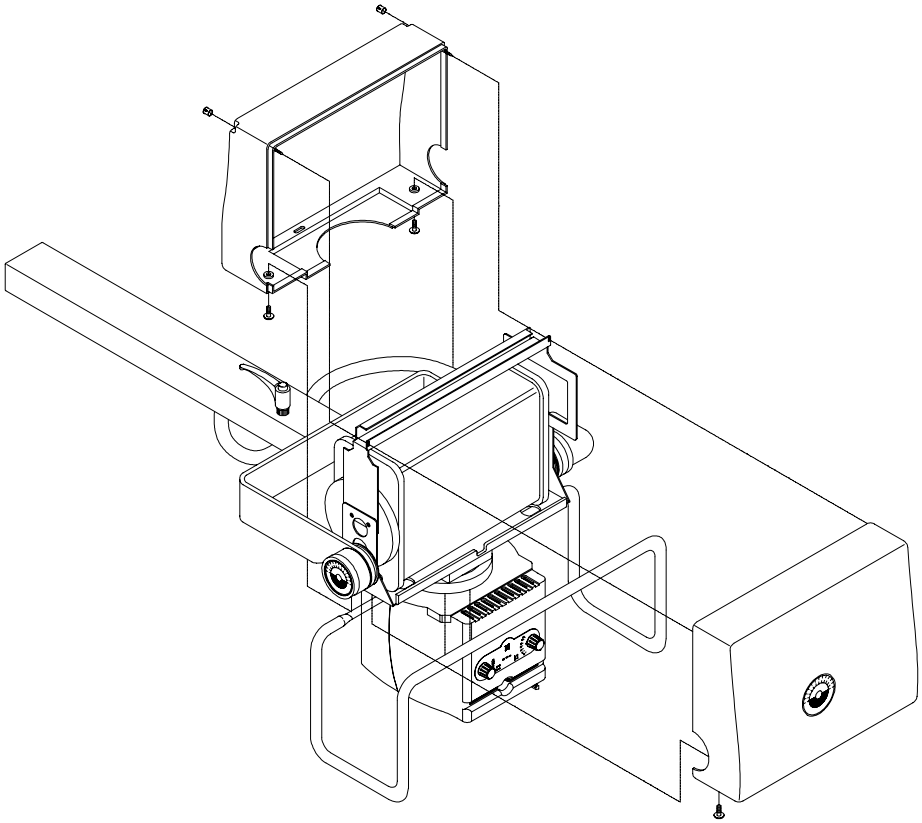






2. *How to remove the monobloc cover.*

Remove the 2 protective cups and loosen the 2 screws placed in the upper part of the monobloc cover.
Loosen the 4 screws placed in the lower part of the cover.
Remove the 2 covers.



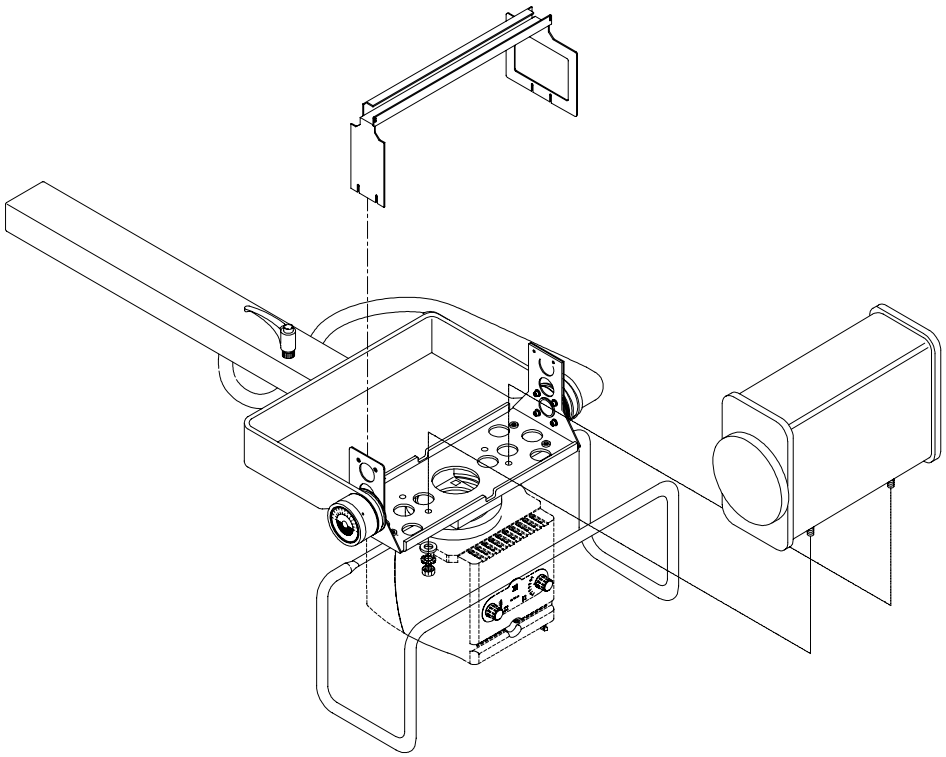
3. *How to remove the monobloc.*

Loosen the 4 lateral screws and remove the monobloc cover support.
Disconnect the supply and signal cables from the monobloc: the connection is performed by tearing clamps. No tool is required, except for the ground conductor.

ATTENTION: the following step is the most dangerous. The rope will be subjected to a sudden tension of several kgf (>60kgf); if rope and hitches are not properly stout the arm could arise suddenly, causing really severe damages for the operators around and the unit. Before removing the monobloc, it is advisable to carefully stretch the rope as much as possible, so that it will be subjected to fewer stresses.

Loosen the 4 nuts with plain and Grower washers which fix the monobloc to the support. This way, the monobloc is completely free and, acting very carefully, can be removed.

For any reason, DO NOT REMOVE or UN-STRECTH the rope.
In this status the unit might be really dangerous, therefore, operate thus to let the unit as less as possible in such condition.
None, except the technician who will re-mount the monobloc, must approach the unit.
Do not let the unit unguarded.



4. *How to re-mount the monobloc.*

Place the monobloc on the support.
Grip the 4 nuts by plain and Grower washers, in order to fix the monobloc to the support and make sure that these are well gripped.
Connect to the monobloc the supply and signal cables: the connection is performed by tearing clamps. No tool is required, except for the ground conductor.
Re-mount the monobloc cover support and grip the 4 lateral screws.

5. *How to re-mount the monobloc cover.*

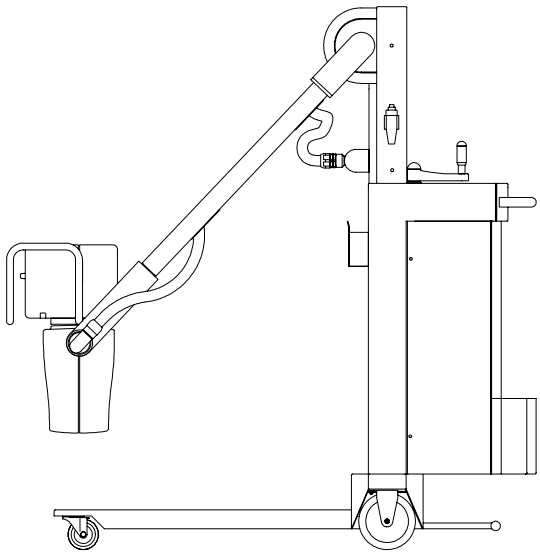
Re-mount the 2 covers.
Grip the 4 screws placed in the lower part of the cover.
Grip the 2 screws placed in the upper part of the monobloc cover.
Re-insert the 2 protective cups.

6. *How to arrange the unit to the functioning.*

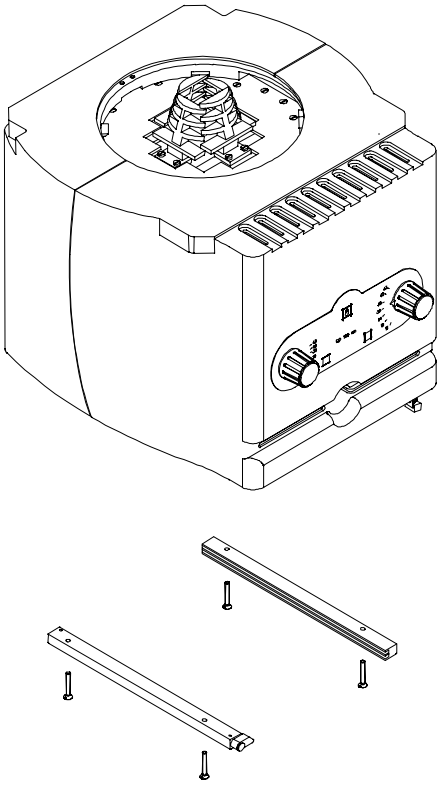
Make sure that the monobloc is well fixed.
Remove the rope ONLY after checking that it is not under tension anymore.
Perform the x-ray tube calibration (see the corresponding par.).
Perform the X-ray beam centering with the rotating adapter (see the corresponding par.).
Check the proper correspondence between X-ray beam and light field of the collimator.

Collimator dismounting

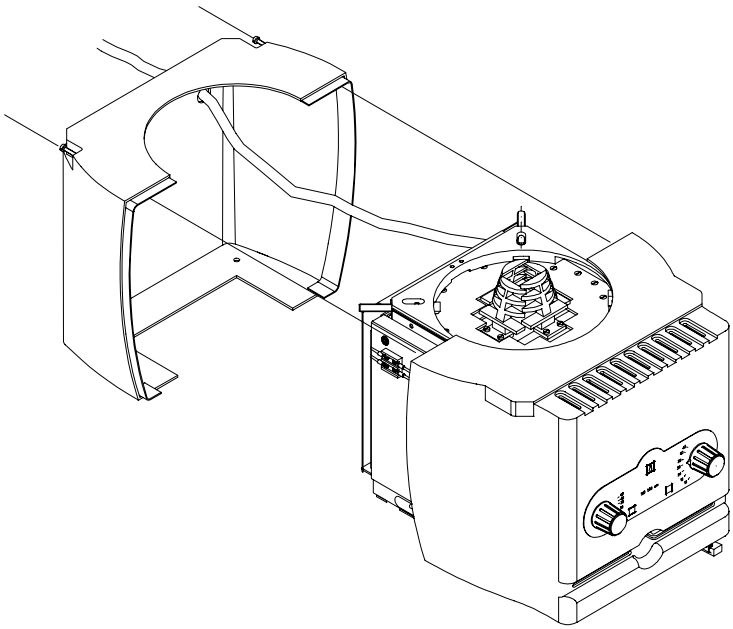
1. Disconnect the unit from the mains.
   Block the unit brakes.
   Park the arm in the lowered position and activate the safety brake.
   Rotate upwards the monobloc/collimator group.



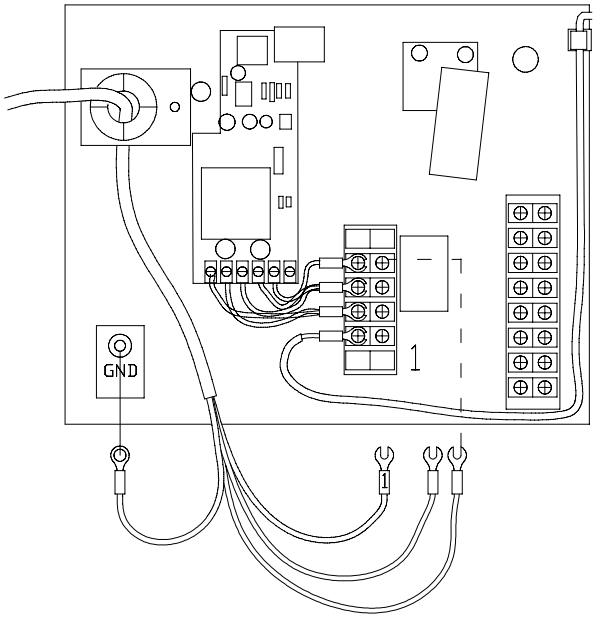
2. Remove the filters holder slides (4 screws).



3. Remove the rear cover (2 screws). Pay attention to wires.

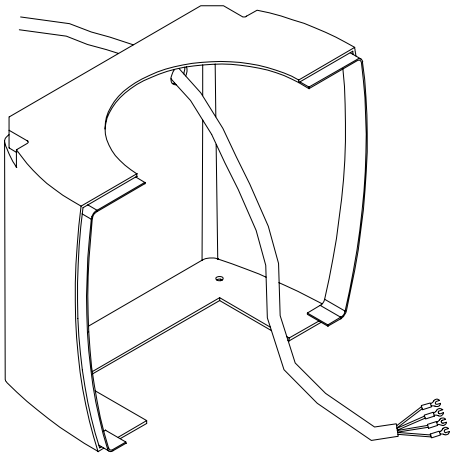


4. Disconnect the cables from the 4 clamps.
Remove the cable clamp (fork wrench ø6mm) and withdraw the cable carefully.



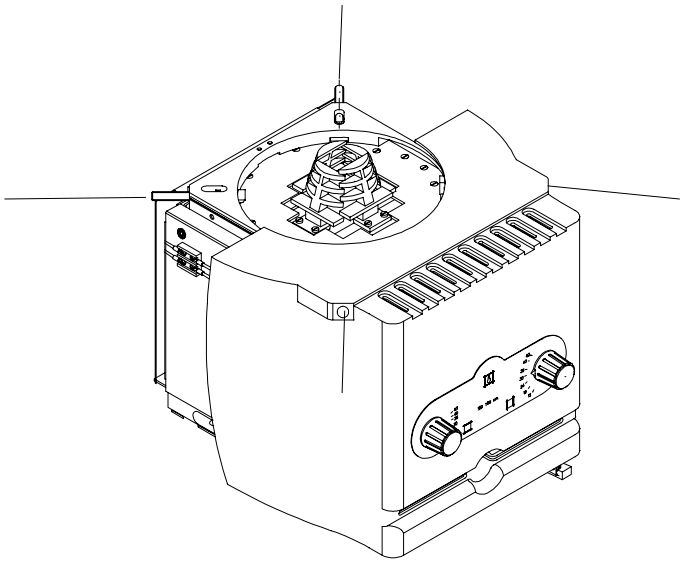
signal	cable	clamp
lamp order	(1) black	1
-	-	2
+V1 (12V DC 9A)	(3) brown	3
0V1	(4) blue	4
GND	(2) yellow/green	GND

5. Withdraw the cable from the hole on the rear cover.



6. If the arm has not been previously blocked it may arise suddenly!!

Loosen the 4 grub-screws in the upper part of the collimator (warning: do not let the collimator fall).



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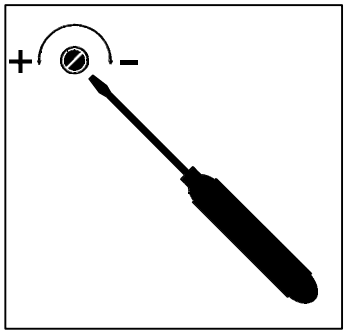
PRACTIX 100 PLUS

ADJUSTMENTS



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SUMMARY

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Trimmers 2
MECHANICAL ADJUSTMENT 4
Collimator 4
Alignment between X-ray beam and rotating adapter 4
Arm balancing adjustment 7
Adjustment of the arm balancing clutch 8
Adjustment of the fork-monobloc clutch 9

ELECTRICAL ADJUSTMENTS

The most important electrical adjustments are performed by the SERVICE MODE (see the corresponding chapter). Therefore, it's possible to modify the operating parameters even if the unit cover is closed (risks and times are reduced).
The adjustments that require the cover removing are already performed by the manufacturer during the unit checking and, usually, must not be re-performed.

X-ray tube calibration

See the chapt. "Service information" → SERVICE MODE → TUBE CALIBRATION option.

Trimmers

Every trimmer is properly set in factory. Regulations can be performed only if strictly necessary. Un-proper regulations may be dangerous.

(CW= clockwise rotation, CCW= counterclockwise rotation)

Board	Trimmer	Value	Test Point	Function
B1 **Keyboard**	P1	-	-	CW →Increases the LCD contrast

Board	Trimmer	Value	Test Point	Function
B4 **Charger**	P1	25kHz	TP4	CCW → Increases the charger converter working frequency
	P2	6µs	TP4	CCW → Increases the Dead Time
	P3	6,80V max	TP6	Sets the capacitors battery voltage (Vc=680V) CW → Increases V_C.
	P4	6,9V max	TP5	Reference voltage for capacitors supervisor circuits. CW → Anticipates the safety circuit intervention time

Board	Trimmer	Value	Test Point	Function
B5 **Chopper Control**	P1	20kHz	TP5	CW→ Increases the chopper working frequency
	P2	-7,5V	TP2	Sets the Chopper output voltage to 375V. CW → Increases the output voltage.
	P3	-5,5V	TP3	Sets the Chopper max. output current to 55A. CCW → Decreases the Chopper max output current

Board	Trimmer	Value	Test Point	Function
B7 **Filament**	P2*	0÷4V	TP3	FIL DAC OUT simulation trimmer: enabled if B4-JP2 is in "b-c" position. CW → Increases.
	P3	17kHz	TP2	CCW → Increases the filament working frequency
	P4*	0÷7V	TP1	mA SET signal simulation trimmer: enabled if B4-JP3 is in "b-c" position (1V=20mA). CW → To increase.
*ONLY FOR FACTORY TEST				

Perform B11 board trimmers regulation with XR ENABLE and XR ORDER signals enabled, but without high level power. Discharge the capacitors battery (procedure described in the chapter "Fault finding") and remove the inverter feeding fuses B6-F1 and F2.

Board	Trimmer	Value	Test Point	Function
B11 **Inverter Control**	P1	10,0Vmax	TP3	Max output voltage of the error amp. (10V)
	P2	16,6kHz	IC9-1	Sets the inverter working frequency. On IC9-1 a symmetrical square wave with 60µs period has to be measured.
	P3	6,25Vmax	TP4	Sets the max. kV SET voltage (6,25V=125kV).
	P4	25µs	IC13-1	Sets the first IGBT "on" time. The impulse is high active for 25µs.
	P5	25µs	IC13-8	Sets the second IGBT "on" time. The impulse is high active for 25µs.

MECHANICAL ADJUSTMENT

Collimator

Alignment between X-ray beam and rotating adapter

Warning: X-ray presence, use proper protections.

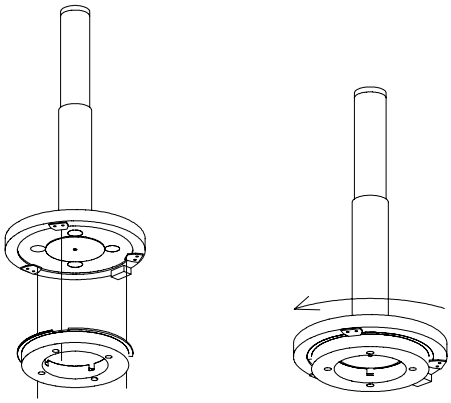
This adjustment has to be performed only in case of monobloc, rotating adapter or handle replacement.

In order to obtain a proper balancing of X-ray source, anode and variable position of the rotating adapter, perform the following operations:

1. Turn the unit OFF and park the arm in the lowered position, then upwards rotate the monobloc with collimator.

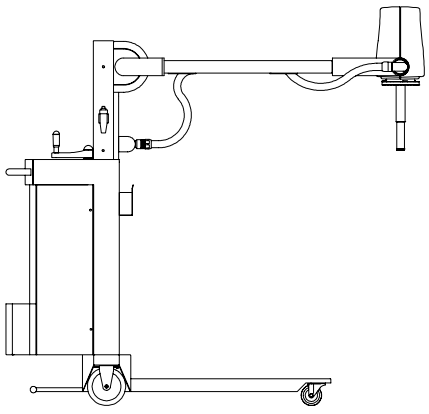
2. Remove the collimator (see the corresponding chapter).

3. Mount the centering tool on the rotating adapter.



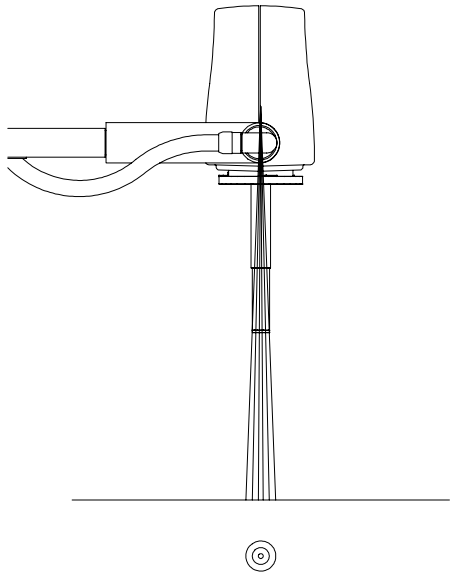
For this operation, plug the centering tool and rotate it until the 4 holes on the tool are aligned with the 4 fixing bolts of the rotating adapter.

4. Unlock the arm and rotate the centering tool downwards.

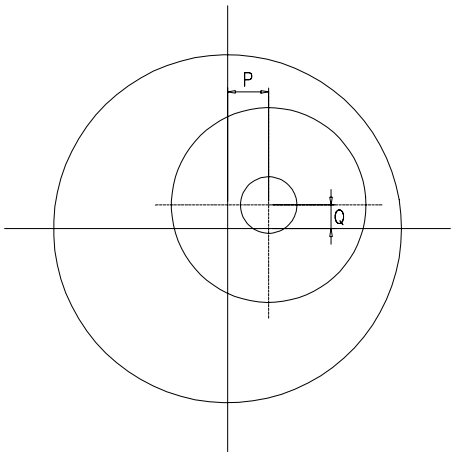


5. Turn the unit ON and wait for the “READY” signal.

6. Take all the radioprotective precautions, then set 60kV/10mAs and perform an exposure.

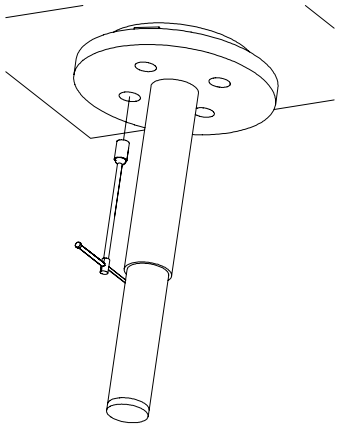


7. Expose the film and measure P and Q distances.



When the P and Q distances are lower than 1mm, the collimator is centered on the tube and no re-adjustment is needed.

8. If, on the basis of the measurement on the film, the rotating adapter is not centered, loosen the four bolts which fix the rotating adapter to the tube, then move the rotating adapter and repeat exposures on the film until the tolerance achieved is less than 1mm.



9. Switch the unit OFF.

10. Grip the four bolts which fix the rotating adapter and remove the centering tool.

11. Re-mount the collimator (see the corresponding chapter).

Arm balancing adjustment

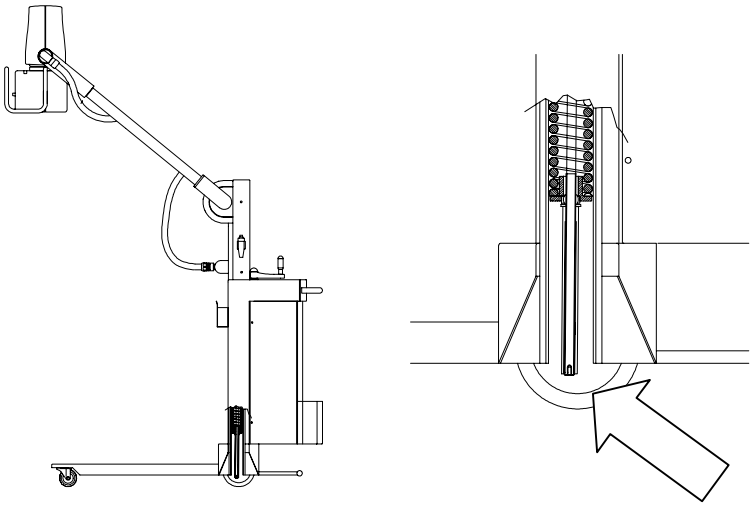
The ideal weight balancing must be obtained with the arm in horizontal position.

The spring nut for the arm balancing is accessible from the bottom of the unit.
Its adjustment must be performed with a Ø19mm fix spanner.

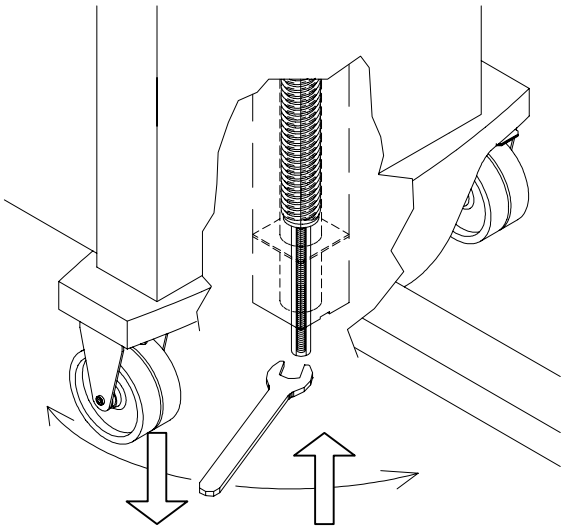
The procedure is as follows:

1. Completely loosen the arm balancing clutch (see the following paragraph)

2. Completely arise the arm.
The hexagonal nut of the balancing spring is accessible from the bottom of the central column.



3. With a fixed spanner (Ø19mm) rotate the nut as follows:
- turn counterclockwise in order to increase the balancing compensation (if the arm goes down)
- turn clockwise in order to decrease the balancing compensation (if the arm goes up)



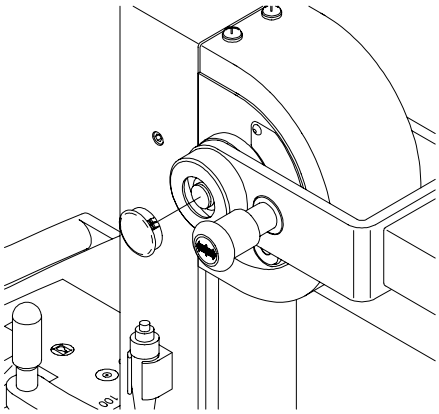
4. Adjust the arm balancing clutch (see the next paragraph)

Adjustment of the arm balancing clutch

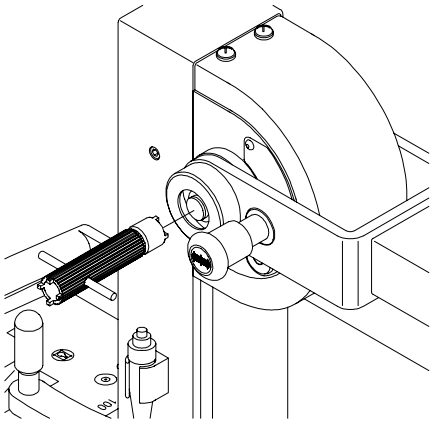
The clutch function is to keep the arm in the wished position even if the proper balancing is not exact.
Usually, the clutch is completely loosened during the weight balancing procedure, and then is gripped until the arm is balanced in every position (even with the arm completely arose or lowered) and the movement is perfectly smooth and regular.

To adjust the clutch:

1. Remove the cup that covers the clutch with a small screwdriver acting on the edge.



2. Using the special tool to adjustment the clutch and rotate the rod.
   - Rotate counterclockwise to loosen the clutch.
   - Rotate clockwise to grip the clutch.



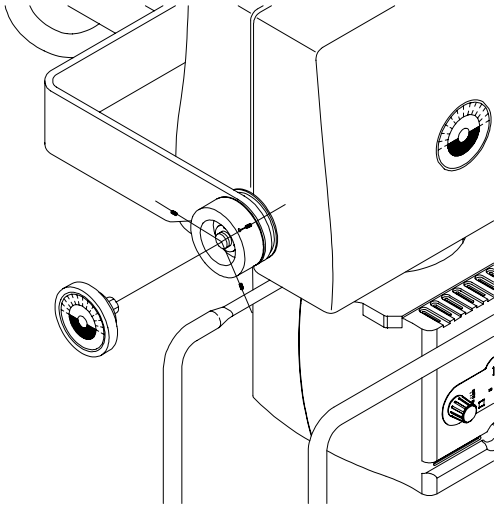
3. Once the adjustment is performed, re-mount the plastic cup.

Adjustment of the fork-monobloc clutch

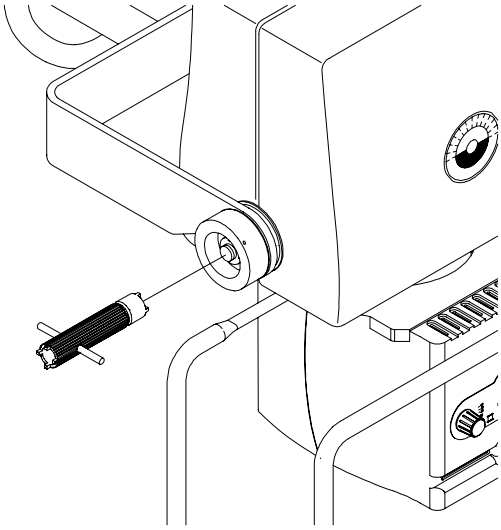
The clutch adjustment is necessary to obtain a smooth movement and to keep the monobloc in the wished position.
In case the monobloc does not keep the wished position grip the clutch.

To adjust the clutch:

1. By means of a hexagonal male wrench loosen the 3 grub screws and remove the goniometer.



2. Using the special tool for the clutch adjustment, rotate the rod.
- Rotate counterclockwise to loosen the clutch.
- Rotate clockwise to grip the clutch.



3. Once the adjustment is performed, re-mount the plastic cup.

DOCUMENT STATUS

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1			
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3			
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PRACTIX 100 PLUS

FAULTS FINDING

[File: W3014_Rev0.doc]

SUMMARY

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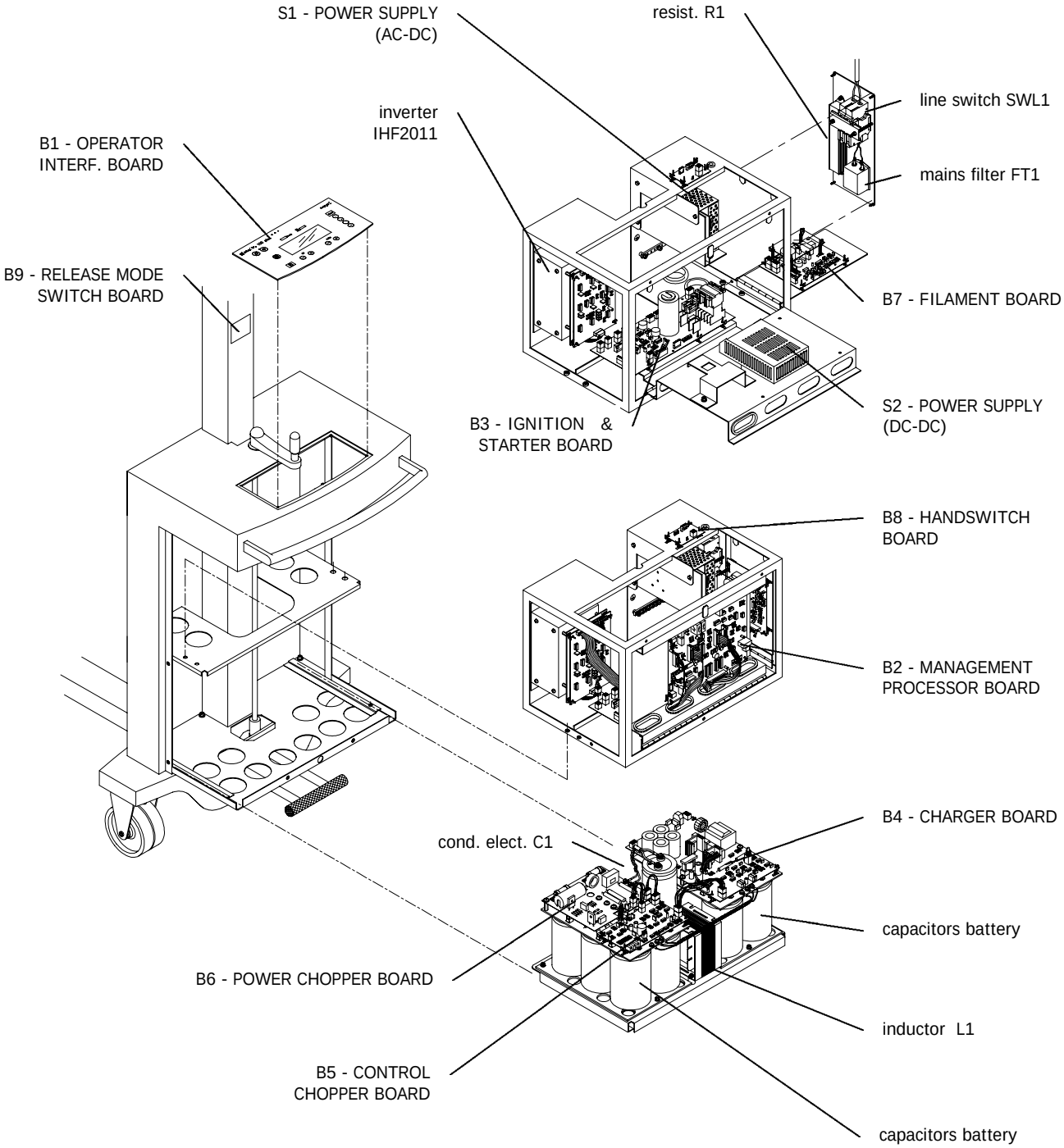
DO NOT PERFORM HAZARDOUS OPERATIONS
ELECTICAL SHOCK DANGER

Even if the mains plug is disconnected a dangerous voltage can be present inside the unit, if the capacitors battery is not completely discharged.

PERFORM THE DISCHARGE PROCEDURE

Before performing any operation on Capacitors Battery, Power Unit and on the Inverter power circuits it is necessary to discharge the capacitors battery.
THE DISCHARGE PROCEDURE IS DESCRIBED AT THE END OF THIS CHAPTER.

BOARDS POSITION



TROUBLESHOOTING GUIDE

Should a fault or a malfunctioning be detected, it is advisable to replace the boards (and not to repair them). The boards provided will be already tested and adjusted.
In case of any adjustment, please refer to the chapter “Adjustments”.

Non-displayed faults

Problem	Likely causes	Remedy	Point to Check
It is impossible to turn the unit ON. The MAINS signal (yellow led) near the ON push button is OFF.	a) Automatic main switch in “0” position. b) Leak of mains voltage. c) Faulty power supply plug. d) Faulty S1 power supplier.	Check that the automatic main switch placed on the right side of the unit is in “I” position. Ensure the presence of the mains voltage to the power supply socket. Ensure that the mains voltage is present inside the unit, the led Ld1 on B3 board should be lighting up. Check the S1-F1 fuse integrity as well as its output voltage. Check the B3-F5 fuse integrity, it feeds the ignition circuit.	SWL1→“I” B3-Ld1→ON S1-F1 B3-Tp1/Tp2 =13,2V B3-F5
It is impossible to perform X-ray. The READY signal (green led) on panel is OFF.	In stand-by phase the voltage to the capacitors battery is lower than 600V. Usually a branch of the capacitors battery has exceeded 350V, the CHARGER may not be properly supplied or faulty.	Check on B4 Charger board the following: - F2 fuse - +VC FAULT and -VC FAULT signals - CHARGER ENABLE signal - DISABLE signal	B4-F2 B4-Ld1→OFF B4-Ld2→OFF B2-Ld27→ON B4-Ld5→ON B4-Ld6→ON B4-Ld7→ON
Collimator lamp doesn’t light up.	The lamp fuse is burnt or the lamp filament is interrupted.	B3-Ld6 led has to be ON. When OFF the B3-F6 is faulty. If the fuse is functioning properly, replace the halogen lamp in the collimator. WARNING. Never handle the lamp glass bulb with un-protected hands. In case of accidental contact immediately wash with water and soap, then dry with a clean cloth.	B3-Ld6→ON B3-F6 Collimator lamp.
The unit is ON but LCD is OFF.	a) B2 board (MPB) faulty or not feeded. b) B1 board (OIB) or LCD are faulty.	Check on B2 board the following: - the 5Vm voltage presence - the efficiency of the flat cable CF1 connection between MPB and OIB.	B2-Tp1/Tp2→5Vm B2-CF1

Displayed faults

Message on Display	Likely causes	Remedy	Point to Check
HAND SWITCH ERR	Upon the ignition the HS PRE and/or HS RAD control is already present. The Handswitch might be faulty.	Check the Handswitch functioning and the integrity of its cable. Ld17 and Ld18 leds, connected to the MPB inputs, should be OFF without controlling the Handswitch. If ON replace the Handswitch. If mounted, please check the optional IR REMOTE CONTROL.	HS PRE→B2-Ld18 HS RAD→B2-Ld17
V2 FAULT CALL SERVICE	Lack of V2 power supply. S2 supplier is faulty, or the Hardware safety circuit intervention occurs.	Check the fuse of S2 supplier. Check on B2 board (MPB) the following: - V2 OK signal - CPU RUNNING signal.	S2-F1 B2-Ld1→ON B2-Ld19→ON B2-Ld4→OFF
V3 FAULT CALL SERVICE	Lack of V3 power supply. The supplying fuses of the Power Unit are burst or the S3 power supplier is faulty.	Check on B3 board (I&S) the following: - F1 and F2 fuses. Check on Charger B4 board the following: - mains voltage presence, - 320 VL continuos voltage, - F1 fuse.	B3-F1 & F2 B4-Ld10→ON B4-F1
POWER FAULT CALL SERVICE	A) Generated by CHARGER FAULT (B4-Ld1 or Ld2 ON). In the Capacitors Battery (CB) there is an unbalancing between the positive and negative branches. Maybe a capacitor is discharging, faulty, or a fuse burst. Usually if the capacitor is faulty, the fuse as a consequence, burns.	⚠ ☠ Before operating, make sure that each capacitor is totally discharged (see the end of this chapter). If the voltage to the capacitors leads is < than 280V, the corresponding green led is OFF. Check the integrity of the protection fuses of every capacitor.	B4-Ld1→OFF B4-Ld2→OFF CB (1/2 left): Ld1÷6→ON F1÷6 CB (2/2 right): Ld1÷6→ON F1÷6
	B) CB has not achieved 650V within approx. 120s from the ignition. Usually a capacitors battery branch has exceeded 350V, or the CHARGER is not supplied or faulty.	Check on the B4 Charger board the following: - F2 fuse - +VC FAULT and -VC FAULT signals - CHARGER ENABLE signal - DISABLE signal	B4-F2 B4-Ld1→OFF B4-Ld2→OFF B2-Ld27→ON B4-Ld5→ON B4-Ld6→ON B4-Ld7→ON
	C) Generated by CHOPPER FAULT (B5-Ld2 ON). The Chopper output voltage exceeded 400V. The IGBT driver circuit or the IGBT itself could be faulty.	⚠ ☠ Enable X-ray preparation, and check on B5 the following: - CHARGER ENABLE signal - VSET signal - VFEED signal - IGBT DRIVER signal ⚠ ☠ Check that there is not a short circuit between Collector and Emitter of the IGBT mounted on B6 board.	B2-Ld27→ON B5-Tp2→-7,6Vmax B5-Tp6→1V=50V B5-TP12 / TP11
CHOPPER FAULT	Chopper device error. It is generated in preparation phase if CHOPPER output is lower than 320V (B5-Ld1 OFF).	⚠ ☠ Enable X-ray preparation, and on B5, check the following: - CHOPPER ENABLE signal - VSET signal - IGBT DRIVER signal	B2-Ld29→ON B5-Tp2→-7,6Vmax B5-TP12 / TP11

Message on Display	Likely causes	Remedy	Point to Check
STARTER INTERLOCK	If during preparation phase the start-current of the anode is not sufficient or missing, no STARTER READY signal is present (B3-Ld5 is OFF)	Check the following: - integrity of B3-F3 and F4 fuses - efficiency of the connection between the B3 board and the stator turns. - STARTER ENABLE signal - B3-K3 relay excitation - STARTER RUN signal	B3-F3 & F4 B3-CM3/CM4 B2-Ld22 B3-K3 B2-Ld20
FILAMENT CALL SERVICE	Min. safety current intervention (green led B7-Ld2→ OFF). Filament current is absent or lower than 220mA. Likely causes: a) Faulty filament fuse b) Faulty filament board c) Faulty DAC circuit on B3 board d) Discontinued filament Max. safety current intervention (red led B7-Ld1→ON). The filament current has exceeded for a while the maximum allowed value (>480mA). Likely causes: a) Faulty filament board b) Faulty DAC circuit on B3 board	⚠ ⚠ Check on B7 board the following: - F1 fuse. - the integrity of connection between the board (B7-CM10) and the filament (B10-CP2). - ±15V2 supplier - FIL DAC OUT signal (in stand-by=2,5V) - FIL SET signal (in st.by = 3,5V) - FIL CUR signal (1V=50mA) - mA SET signal (1V=20mA)	B7-F1 B7-Tp5, Tp9, TP4 B7-Tp3 B7-Tp7 B7-Tp8 B7-Tp1
LACK OF X-RAY	The kV value has not reached the 85% of the set value in the first 10ms of exposures, or there is not high voltage. Likely causes: a) The inverter doesn't send kV>85% signal. b) Chopper and Inverter protective fuses are discontinuos.	⚠ ⚠ ⚠ Perform an exposure and check the KV>85% signal presence on the boards: B11-Ld1→ON B2-Ld11→ON If the leds won't light up discharge the capacitors battery and check the B6-F1 and B6-F2 extra fast fuses integrity.	B11-Ld1 B2-Ld11 B6-F1 & F2
INVERTER KV ERROR	a) High voltage circuit in the X-ray assembly is unbalanced or kV feed-back is not present during an exposure or it is out of range. The red led B11-Ld3 is on. b) During X-ray emission the kV decrease under 85%. The Inverter missing the kV>85% (during emission B11-Ld1 turns OFF). c) During X-ray emission the kV increase over 110% of set value (software control on TUBE KV analog signal).	⚠ Perform an exposure and check on the Inverter B11 board the following: - KV FEED signal (1V = 20kV) - the KV+ and kV- signals balancing - kV>85% signal - TUBE KV signal (1V = 20kV)	B11-Tp1 B11-Tp5 e Tp6 B11-Ld1→ON B2-Tp6

Message on Display	Likely causes	Remedy	Point to Check
INVERTER OVERLOAD	Inverter current absorption is too high (Ipk>300A). Red led B11-Ld4 lights up. Monobloc fault or too high anodical current.	**in preparation phase** check on B7 board the following signals: - FIL DAC OUT - mA SET - FIL CUR **in radiography phase** - ANODIC mA - mA STABILIZATION	B7-Tp3 B7-Tp1 (1V=20mA) B7-Tp8 (1V=100mA) B11-Tp8 (1V=20mA) B2-Ld26
INVERTER FAULT	IGBT drivers error. B11-Ld5 red led lights up.	Perform an exposure. Replace the Inverter if the fault persists.	
MAX TIME	The max exposure time (2s) has been achieved. XR ORDER circuit (X-ray order is always ON) or the filament control one (anodic mA too low) might be faulty.	Check that the B2-Ld24 led (XR ORDER signal) is ON only during the X-ray time. Check the anodic mA value; if un-proper, check the following on B7 board: - FIL DAC OUT signal - mA SET signal - FIL CUR signal - mA STABILIZATION signal	B2-Ld24→OFF B11-Tp8 (1V=20mA) B7-Tp3 B7-Tp1 (1V=20mA) B7-Tp8 (1V=100mA) B2-Ld26
DATA ERR. CALL SERVICE	Checksum data error, memory error. The EEPROM memory B2-IC21 is faulty.	Replace the B2-IC21 IC.	
ERR. TUBE CALIB. CALL SERVICE	Data in the memory are out of range. These could be wrong or the EEPROM B2-IC21 faulty.	Perform the tube calibration, if the error persists please replace B2-IC21 IC.	
TUBE SEASONING	After a long period of un-use (3 months or more) it's necessary to perform the X-ray tube seasoning, in order to avoid any damage.	Perform the tube seasoning.	

Message on Display		Likely causes	Remedy	Point to Check
Dosimeter	INACTIVE	The dosimeter chamber is active but MPB does not recognize it.	Check the following: - the connection efficiency between MPB board and DOSIMETER - the 15Vd supply presence - the TEST SIGNAL presence (B2-Ld32 high active for 1s) at start-up.	S2-7/8 B2-Ld32
	NOT OK	The chamber is active but the feedback pulses are out of range.	Check the efficiency of the connection between MPB board and DOSIMETER.	215 < PULS > 275

DESCRIPTION

Signals

Power supplies signals		
Mnemonic	**Signal description**	**Path**
MAIN SUPPLY	115V±10% mains voltage or 230V±10%, 50/60Hz. It is connected to the ac/dc S1 power supplier and, through the B3-K1 relay, to the Power Unit. The voltage presence is indicated by the green led B3-Ld1.	Plug → Filter → B3 → B4
+V1	The S1 power supplier generates the +V1 power supply (13Vdc), it is present even if the unit is OFF. It supplies the insertion circuit, the collimator and dc/dc S2 power supplier. If voltage is present, the green led placed on the keyboard near the "on" key, lights up. This voltage is referred to GND.	S1 → B3 → Collimator
+12V1	The +V1 voltage supplies the B3-Q1-E transistor. Upon the unit ignition, the Q1-C transistor transfers the +12V1= (+V1- Vcesat) voltage to the starter checking circuits. Furthermore, it supplies the Handswitch and the Infrared Handswitch optional accessory.	S1 → B3
± 15V2	The V2 power supply (±15Vdc) is generated by the S2 power supplier and is present upon the unit turning ON. This voltage supplies the Hardware safety circuits and if no fault is present, through the B2-K2 relay, also the Filament and Inverter checking circuits and some in/out circuit on MPB are supplied.	S2 → B2
Vd	+15Vd power supply for dosimeter; generated by S2 and not referred to GND.	S2 → B2 → Dosimeter
Vm	+5Vm power supply for CPU; generated by S2 and not referred to GND.	S2 → B5
VL	Rectified and filtrated mains voltage for the (320Vdc) Charger and Filament power supply. Its presence is indicated by the green led B4-Ld10. ATTENTION! Circuits are not isolated from the mains, (LIVE) danger of severe electrical shock.	Line → B3 → B4 → B7

Ignition signals		
Mnemonic	**Signal description**	**Path**
ON	ON control by keyboard.	B1 → B3
OFF	OFF control by keyboard.	B1 → B3
S2 ENABLE	Enabling signal for S2 power supplier. It is present with the unit in "on" status.	B3 → S2
LINE 115	It indicates to MPB if the unit is supplied at 230V or at 115V, in order to fix the start time and brake time of the rotating anode. Vrete=230V → B3-Ld2=ON → time=0,8s Vrete=115V → B3-Ld2=OFF → time=1,6s Trip point=150V	B3 → B5

Hardware safety signals		
Mnemonic	**Signal description**	**Path**
V2 OK	High active signal. In case of unbalancing between the V2 pos. and neg. the signal is missing, the red led B2-Ld2 lights up and the "V2 FAULT CALL SERVICE" alarm is displayed. For safety reasons, the B2-K1/K2 relays are disexcited, taking off the V1voltage to the X-ray key, ±V2 power supply to Inverter and Filament and the V3 to the Charger/Chopper control signals. To reset the safety status, turn the unit OFF.	B2
CPU RUNNING	High active signal. If the program blocks the signal is missing and the red led B2-Ld4 lights up. For safety reasons, the B2-K1/K2 relays are unexcited, taking off the V1voltage to the X-ray key, ±V2 power supply to Inverter and Filament and the V3 to the Charger/Chopper control signals. To reset the safety status, turn the unit OFF.	B2
MAX XR TIME	Low active signal. In case the exposure time is > 2,1s (Red led B2-Ld3 → ON), the hardware safety blocks the unit functioning. For safety reasons, the B2-K1/K2 relays are unexcited, taking off the V1 voltage to X-ray key, ±V2 power supply to Inverter and Filament and V3 to the Charger/Chopper control signals. To reset the safety status, turn the unit OFF.	B2

X-ray control signals		
Mnemonic	**Signal description**	**Path**
HS COM	Handswitch +12V1power supply. It is selected by the hardware safety circuit through the B2-K2 relay.	HS → B8 → B3-B2
HS PRE	X-ray preparation request of the "dead man" type. (Yellow led B2-Ld18 → ON).	HS → B8 → B3-B2
HS RAD	X-ray request of the "dead man" type. (Yellow led B2-Ld17 → ON).	HS → B8 → B3-B2
THERMAL SAFETY	It is active with the medium temperature > 57°C of the monobloc (Yellow led B2-Ld6 → OFF). Its intervention let the eventual current exposure complete, then the "HOT TUBE" message is displayed and any other X-ray request is blocked, until the monobloc returns to a lower temperature.	B3 → Monob → B3 → B2
REALISE MODE SWITCH	Slide switch at two positions that allows the selection of the X-ray request; Handswitch or Infrared remote control. The mounting in series of the Infrared remote control is not foreseen.	B9

Charger signals		
Mnemonic	**Signal description**	**Path**
V3	±15V3 power supply for the Chopper and Charger checking circuits. Voltages presence is indicated by the green led B4-Ld9 (+) and B4-Ld8 (-). This voltage is referred to GND.	B4
Vc	Voltage to the capacitor battery leads (±350Vc); the 0Vc is connected to GND. ATTENTION! If capacitors haven't been discharged this voltage is present even if the unit is OFF and unplugged. The natural discharge requires approx.3h. the capacitor charging status is indicated by the green led B4-Ld3 (branch +) and B4-Ld4 (branch -), that light up to 35V voltage per each branch. It's possible to discharge the battery instantaneously operating by the keyboard (SERVICE MODE → DIAGNOSTIC menu → CAPACITORS option) or pressing the red button B4-PB1 for a while. ATTENTION! Before operating on the Power Unit verify, by means of a Voltmeter, that every capacitor is completely discharged. Do not perform risky operations. Dangers of severe electrical shock even if the unit is OFF.	B4 → Cap.Bat → B5
+VC -VC	Voltages feedback of the capacitors battery positive and negative branches. They are also used in the unbalancing circuit and voltage max safety. The unbalancing is indicated by the red leds B4-Ld1(+) and B4-Ld2 (-).	B4
V3 OK	It is generated by the ±15V3 supply voltage supervisor. In case the V3 power supplier is faulty, the green led B4-Ld11 is OFF and the "V3 FAULT CALL SERVICE" alarm is displayed.	B4 → B2
CHARGER ENABLE	Capacitors charge enable signal. It is generated by MPB upon the "start up test" end, and disappears during X-ray.	B2 → B4
CHARGER FAULT	High active when the voltage of a capacitor battery branch is higher then 350Vc. If it is active the capacitor charge is blocked via hardware and "POWER FAULT CALL SERVICE" is displayed.	B4 → B2
BAT DISC	For safety reasons, the Chopper Fault signal trigs the capacitors battery discharge. The discharge can be also activated by keyboard in SERVICE MODE → DIAGNOSTIC menu → CAPACITORS option. The lighting up of the red led B4-Ld12 indicates the discharging circuit trig.	B2 → B4
VBAT	Analogic signal for the battery voltage measurement in 1/100 format in the 0-7V range. It is converted into frequency on MPB (1V→2kHz), to indicate the battery voltage.	B4 → B2
RES	Initial active low reset. It is generated upon the ignition and blocks the battery charge for approx.500ms.	B4
DISABLE	When high active it blocks the converter for the battery charge. The yellow led B4-Ld5 is OFF.	B4
CHARGER OFF	Generated when the capacitor battery reaches the requested charging value. (±340Vc). Its typical hysteresis is of 5Vc. The signal is low active.	B4
STOP	Safety signal generated by a chopper fault condition or a battery discharge. The signal is active and permanent. To deactivate it, turn the unit OFF and ON again.	B4

Charger signals		
Mnemonic	**Signal description**	**Path**
+VC FAULT -VC FAULT	High active safety signals. The capacitor charge is blocked when the voltage of a battery branch is more than 350V. (the checking circuit of the charge could be faulty or an unbalancing between the positive and negative branches of the battery has happened). The intervention is indicated by red leds B4-Ld1(+) or B4-Ld2 (-) and the "POWER FAULT" alarm is displayed. To reset the block, turn the unit OFF and ON again.	B4
SCR ON	Safety signal. It is active if the discharging thyristor B4-TH2 is "on", in this status the battery is blocked. The charge is automatically enabled when TH2 returns in "off" status.	B4

Control Chopper & Chopper signals		
Mnemonic	**Signal description**	**Path**
V3	±15V mains voltage for the Charger and Chopper checking circuits. This voltage is referred to GND.	B4 → B5
Va	±13V mains voltage for the IGBT driver. It is generated from a dc/dc of +15V3. ATTENTION! this voltage is NOT referred to ground but connected to Vc. Danger of electrical shock.	B5
CHOPPER ENABLE	This signal is generated by MBP for the Chopper enablation. In stand-by status the chopper output voltage is kept at 320Vdc max. During preparation, or X-ray, it reaches 380Vdc max.	B2 → B4 → B5
CHOPPER READY	This signal is high active when the chopper output voltage is more than 320V. To allow X-rays the signal must be active.	B5 → B4 → B2
CHOPPER FAULT	High active high signal. If, and anytime, the Chopper output voltage is >400V, the signal is generated, blocking the Chopper and Charger functioning. For safety reasons, the capacitor battery discharge is automatically trigged. The "POWER FAULT CALL SERVICE" alarm is displayed.	B5 → B4 → B2
ISET	Setting of the max. output current from the Chopper in 1V→10A (B5-TP3) format. Typical value: 50A.	B5
VSET	Setting of the max output voltage from the Chopper in 1V→50V (B5-TP2) format. Typical value: 370V.	B5
EN	In case of high signal, the error amplifier outputs and the PWM circuit output are activated.	B5
IEA	Output signal of the current error amplifier.	B5
VEA	Output signal of the voltage error amplifier.	B5
SEA	Sum signal of the error amplifiers. If the signal is at low level, the Chopper power transistor is interdicted.	B5
FAULT	Equal to the "Chopper fault" signal, but low active. It blocks the transfer of the PWM signal to the IGBT Driver.	B5

Starter signals		
Mnemonic	**Signal description**	**Path**
STARTER ENABLE	Safety signal generated by high active MPB. It controls the B3-K3 relay, that selects the TH1/TH2 Triac and the mains stator. The relay is controlled so that its contacts always close and open in "zero power" status, therefore with "off" Triacs.	B2 → B3
STARTER RUN	Generated by the high active MPB that, by means of TH1 and TH2 Triac, let the rotating anode stator run. The start time is fixed by the mains voltage and controlled by MPB: 230V→0,8sec; 115V→1,6sec.	B2 → B3
STARTER BRAKE	Generated by high active MPB guiding the TH2 Triac.TH2 supplies only in half wave the stator main wrapping, aimed to block the anode during the rotation. The brake time is fixed by the mains voltage and controlled by MPB 230V→0,8sec; 115V→1,6sec. Braking can be disenabled in set up phase. (SERVICE MODE → SETUP menu → Brake OFF).	B2 → B3
STARTER READY	High active signal (B3-Ld5 → ON), present during the whole starting phase, if currents flowing in the stator are higher than the pre-fixed minimum. If currents do not exceed the minimum fixed, the "STARTER INTERLOOK" alarm is displayed.	B3 → B2
PRINC	Principal winding (R=20Ω). ATTENTION! Danger of electrical shock, mains voltage.	B3 → Monobloc
SHIFT	Shift winding (R=50Ω). ATTENTION! Danger of electrical shock, mains voltage.	B3 → Monobloc
COM	Common windings. ATTENTION! Danger of electrical shock, mains voltage.	B3 → Monobloc

Filament signals		
Label	**Signal description**	**Path**
VL	Rectified and filtrated mains voltage (320Vdc) to supply the filament and its power circuit (half bridge). The fuse B7-F1 of 1A selects it. Attention! Mains voltage circuits. Danger of electrical shock.	Line → B3 → B4 → B7
FIL DAC OUT	Voltage generated by MPB for the filament ignition. In stand by its value is +2V. In preparation, it is in function of the kV and mAs set parameters and can reach +4V.	B2 → B7
FIL SET	Control voltage for the filament ignition with the 1V→100mA format. Its value is determined by the FIL DAC OUT voltage added to 1V. [V FIL SET = V FIL DAC OUT + 1]	B2 → B7
FIL CUR	Voltage proportional to the filament current with 1V→50mA format. Its max filament current is of approx. 480mA.	B2
mA SET	Voltage generated by MBP comprised between +3,7V at +7,0V. It is sent to the automatic adjustment circuit of the anodic current, as reference voltage. Its value is in function of the set kV and mAs parameters; the correspondence is 1V→20mA.	B2 → B7
ANODIC mA	Voltage generated by the tube anodic current; the correspondence is 1V→20mA, between 0 and 7V. This signal is sent to the filament, as feedback, for the mA adjustment and to MPB for the mAs counting, therefore it determines the exposure block.	Monob → B11 → B2 → B7
mA STABILIZATION	High active signal generated by MPB. It enables the circuit of the automatic adjustment for the anodic current. For safety reasons it is cut from the Handswitch and is active only during X-ray.	B2 → B7
FILAMENT READY	This signal is high active (B7-Ld2 ON) if the filament current is comprised between 220mA and 480mA. A current out of range blocks the unit functioning and the "FILAMENT CALL SERVICE" alarm is displayed. If the alarm has been generated by a current > than 480mA the red led B7-Ld1 lights up and stores the intervention of the max. current safety. This safety intervention excites the B7-K1 relay, cutting the filament, to protect it from over-current. To reset the safety status, turn the unit OFF.	B7 → B2

Inverter signals		
Mnemonic	**Signal description**	**Path**
kV SET	Voltage generated by MPB for the kV setting to the X-ray tube. The format is kV/20 and the range from 2 to 6,25V	B2 → B11
XR ENABLE	High active signal for the inverter enablation (Yellow led B2-Ld23→ON). The signal is cut by the Handswitch and by the hardware safety circuits.	B2 → B11
XR ORDER	High active signal for x-ray control (Yellow led B2-Ld2→ON). It also trigs the MAX XR TIME timer for the hardware safety. (2,1s) For safety reasons it is cut by the Handswitch and by the hardware safety circuits. To obtain X-ray, the inverter has to be enabled.	B2 → B11
kV>85%	High active signal. Generated by the inverter when the High Voltage is more than the 85% of the set kV value. (Yellow led B11-Ld1→ON). This signal enables the mAs counting start.	B11 → B2
TUBE kV	Voltage proportional to the High Voltage applied to the tube; the correspondence is 1V→20kV. It is sent to the MPB for the kV measurement in SERVICE MODE.	B11 → B2
KV/20	Voltage proportional to the High Voltage applied to the tube; the correspondence is 1V→20kV. This signal is used for the electrical kV measurement and is connected to the kV adjustment circuits as comparison voltage.	B11
ANODIC mA	Voltage generated by the tube anodic current; the correspondence is 1V→20mA. This signal is sent to the filament as feed back for the mA adjustment and to MPB for the mAs counting, therefore it determines the exposure time.	Monob → B11 → B2 → B7
kV FAULT	High active fault signal that blocks the exposure (Red led B11-Ld3→ON). It is generated by the inverter in case of unbalancing on High Voltage or lack of feedback. Usually it is caused by a fault in the monobloc (Tube, diodes, coils...). The INVERTER kV ERR" alarm is displayed.	B11 → B2
OVERLOAD	High active fault signal. It is generated when the current value absorbed by the monobloc is too high; the inverter functioning and X-ray are blocked. (Red led B11-Ld4→0n). This can happen in case of: High Voltage in the monobloc, too high anodic mA value (usually in the tube calibration phase), or a monobloc fault. (Tube, diodes, coils...). The "INVERTER OVERLOAD" alarm is displayed.	B11 → B2
IGBT FAULT	High active fault signal (Red led B11-Ld5→ON). It is generated when in the Inverter IGBT drivers occurs an unsafe control or a functioning defect. The "INVERTER FAULT" alarm is displayed.	B11 → B2
RESET FAULT	High active signal. It is a pulse of approx. 20ms generated by the MPB upon the anode starting phase ending. It is necessary to reset an eventual inverter fault happened in the foregoing exposure. (B2-Ld25→ON).	B2 → B11

Collimator signals		
Mnemonic	**Signal description**	**Path**
+V1	Mains voltage. (13Vdc-8A) The green led B3-Ld6 indicates the voltage presence and the fuse integrity B3-F6 of 10A.	S1 → B3 → Collimator
LAMP REQUEST	Request of collimator lamp turning ON, by keyboard or Infrared Remote Control.	B1 → B3
LAMP ORDER	Low active signal. It trigs the timer for the lamp turning ON. Once the timer has been trigged, the lamp lights up for approx. 30s.	B3 → Collimator

Dosimeter signals Dosimeter is not provided in standard configuration. To activate it, during installation phase, it is necessary to get access to the SERVICE MODE and to the CONFIG menu.		
Mnemonic	**Signal description**	**Path**
Vd	15V voltage for the dosimeter power supply. This voltage generated by the S2 power supply is electrically divided by the othes and is not referred to GND.	S2 → B2 → Collimator → Dosimeter
TEST SIGNAL	5s, after the unit ignition the signal is generated by the MPB and sent to the dosimeter. (Yellow led B2-Ld32→ON). The pulse duration is 1s long, high active. Following the TEST SIGNAL the dosimeter sends a series of pulses. For a proper functioning, the response pulses must be comprised between 215 and 275. Three different cases are foreseen: 1) Return pulses are in the range; the display shows on the first line ”Dosimeter ACTIV”. 2) Return pulses are out of range; the display shows “Dosimeter NOT OK”. 3) No return pulse is read; the display shows “Dosimeter INACTIV”. The message on the display is cancelled after approx.5s. If the first case has occurred, the first line shows ”cGYcm2”.	B2 → Collimator → Dosimeter
PULS SIGNAL	With X-rays the dosimeter generates pulses in current. The quantity is proportional to the dose that flows in the dosimeter in 1 pulse→0,1cGy cm² format. The pulse width (with current) is of approx. 1,5µs for a max. of 300.000 pulses per second. Following the TEST SIGNAL the dosimeter responds with a series of pulses. For the proper functioning the pulses must be comprised between 215 and 275. Upon the unit ignition to a max. of 5s, the dosimeter can generate casual pulses; these have to be disregarded.	Dosimeter → Collimator → B2

Leds

Green led = G In the normal functioning they have to be **ON**.
One G led in OFF status indicates a faulty condition or busy.
Usually it indicates the presence of a power supply.

Yellow led = Y Indicting a function activity.

Red led = R In the normal functioning they have to be **OFF**.
One R led in ON status indicates an anomaly or a faulty status.

Board	Led	Color	Function with led on
B1 **Key-board**	Ld1÷3	G	The unit is in ready status, therefore enabled to operate.
	Ld4÷6	Y	X-ray emission signal.
	Ld7	Y	V1 voltage presence and integrity of the B3-F5 fuse for the insertion circuits power supply.

Board	Led	Color	Function with led ON
B2 **MPB**	Ld1	G	Safety signal not present; No fault detected.
	Ld2	R	Voltage V2 → KO, faulty.
	Ld3	R	**Max XR Time.**Exposure time > than 2,1s.
	Ld4	R	**CPU Running** Um-proper or absent program flow.
	Ld5	Y	**IN "Starter Ready" -** Sufficient anodical current. Enabled only in start time.
	Ld6	G	**IN "Thermal Safety" -** ON when the monobloc temperature is proper to operate (<57°C)
	Ld7	Y	**IN "Line 115" -**ON with main line voltage = 230V
	Ld8	R	**IN "IGBT Fault" -**Faulty Inverter.
	Ld9	R	**IN "Over-current" -**Over-loaded inverter.
	Ld10	R	**IN "kV Fault" -**Faulty Inverter or monobloc.
	Ld11	Y	**IN "kV>85%" -**ON when kV are > 85% of set value.
	Ld12	G	**IN "Filament Ready" -**Filament current in range.
	Ld13	G	**IN "V3 OK"-**Voltage V3 → OK
	Ld14	R	**IN "Charger Fault" -**The voltage of the capacitors battery is wrong (> 350V or unbalanced).
	Ld15	Y	**IN "Chopper Ready" -**ON if chopper output voltage is > than 320V.
	Ld16	R	**IN "Chopper Fault" -**The Chopper output was > than 400V for a time longer than 5ms.
	Ld17	Y	**IN "HS RAD" -**X-ray emission request by Handswitch.
	Ld18	Y	**IN "HS PRE" -**X-ray preparation by Handswitch.
	Ld19	G	**IN "V2 OK" -**Voltage V2 → OK
	Ld20	Y	**OUT "Starter Run" -**ON in the anode start time phase.
	Ld21	Y	**OUT "Starter Brake" -**ON in the anode braking phase.
	Ld22	Y	**OUT "Starter Enable" -**ON in start time or when is breaking.
	Ld23	Y	**OUT "XR Enable" -**ON to enable the inverter.
	Ld24	Y	**OUT "XR Order" -**ON with X-ray control.
	Ld25	Y	**OUT "Reset Fault"**- ON for 20ms at the end of anode start time.
	Ld26	Y	**OUT "mA Stabilization" -**ON in correspondence of the X-ray exposure.

Board	Led	Color	Function with led ON
B2 **MPB**	Ld27	Y	**OUT "Charger Enable"**
	Ld28	R	**OUT "Bat Disc" -** ON when the battery discharge is controlled by the keyboard. (SERVICE MODE).
	Ld29	Y	**OUT "Chopper Enable"**
	Ld30	Y	**OUT -** In normal condition the led pulses with f = 4Hz
	Ld31	Y	**OUT "Autocal" -** Always ON, when OFF it performs the V/f converters auto-calibration.
	Ld32	Y	**OUT "Test Dos" -**After 5s from the ignition it is active for 1s and enables the dosimeter test.

Board	Led	Color	Function with led ON
B3 **on/off starter collimator**	Ld1	G	Mains voltage presence.
	Ld2	Y	Mains voltage = 230V
	Ld3	Y	The starter capacitive current is ready.
	Ld4	Y	The starter main current is ready.
	Ld5	Y	**Starter Ready.**The starter currents are ready. Enabled only during start time.
	Ld6	G	V1 voltage is OK and fuse B3-F6 is OK (collimator feeding voltage).

Board	Led	Color	Function with led ON
B4 **Charger**	Ld1	R	Battery positive branch > than 350V.
	Ld2	R	Battery negative branch > than 350V.
	Ld3	G	Monitor of the battery positive voltage.
	Ld4	G	Monitor of the battery negative voltage.
	Ld5	Y	ON to enable the battery charge.
	Ld6-Ld7	Y	Converter and charger driver monitors. ON when the unit is charging.
	Ld8	G	Voltage -15V3 → OK
	Ld9	G	Voltage +15V3 → OK
	Ld10	G	Voltage 320V → OK and fuses B3-F1 & F2 are Ok.
	Ld11	G	**V3 OK -** Voltage V3 → OK and fuse B4-F1 is Ok.
	Ld12	R	Battery discharge circuit (crowbar) driver enables.

Board	Led	Color	Function with led ON
B5 **Control Chopper**	Ld1	Y	**Chopper Ready -**ON if the chopper output voltage is > than 320V.
	Ld2	R	**Chopper Fault -**The chopper output was > than 400V for a time longer than 5ms.

Board	Led	Color	Function with led ON
B7 **Filament**	Ld1	R	The filament current was > than 480mA for a time longer than 120 ms.
	Ld2	G	**Filament ready -**Filament current in the range.

Board	Led	Color	Function with led ON
B11 **Inverter**	Ld1	Y	**kV>85%** - is ON when kV value is > than 85% of set value.
	Ld2	R	Not used.
	Ld3	R	**kV Fault** -Faulty Inverter or monobloc.
	Ld4	R	**Overload** -Overloaded Inverter.
	Ld5	R	**IGBT Fault** -Faulty Inverter.

Board	Led	Color	Function with led ON
Capacitors Battery	Ld1÷6	G	Show capacitors charge and capacitors fuses state. WARNING: electrical shock danger. Before any operation make sure, by means of a voltmeter, that capacitors are completely discharged.

Test point

OIB					
B1	**description**	**ref. to**	**right value**	**range**	**format 1V=↓**
Tp1	+5Vm supply	TP2	+5V	±0,3V	---
Tp2	0Vm supply	floating	---	---	---

MPB					
B2	**description**	**ref. to**	**right value**	**range**	**format 1V=↓**
Tp1	+5Vm supply	TP2	+5V	±0,3V	---
Tp2	0Vm supply	floating	---	---	---
Tp3	Output DAC of filament current set	Tp18	2,5Vst.by	2÷4V	---
Tp4	Input ADC of filament current (FIL CUR)	Tp18	9,6Vmax	0÷9,6V	50mA
Tp5	Output DAC of mA SET	Tp18	7Vmax	1,9÷7V	20mA
Tp6	Input ADC of monobloc voltage(TUBE kV)	Tp18	6,3Vmax	0÷6,3V	20kV
Tp7	Output DAC of kV SET	Tp18	6,3Vmax	2÷6,3V	20mA
Tp8	Voltage reference for ADC & DAC	Tp18	2,048V	---	---
Tp9	Input V/f converter of ANODIC mA	Tp20	7Vmax	0÷7V	20mA
Tp10	Output V/f converter of ANODIC mA	TP2	---	0÷14kHz	2kHz
Tp11	Input V/f converter of VC (cap.bat voltage)	Tp20	6,8Vmax	0÷7V	100V
Tp12	Out V/f converter of VC (cap.bat voltage)	TP2	---	0÷14kHz	2kHz
Tp13	Voltage reference for V/f converter	TP2	8,2V	---	---
Tp14	XR-ORDER signal	TP2	+15V	---	---
Tp15	There is not				
Tp16	Converters supply after solid state fuse F1	Tp18	+15V	±0,5V	---
Tp17	Supply after regulator VR1	Tp18	+5V	±0,3V	---
Tp18	Converters supply	GND	0V	---	---
Tp19	+15V2 analog and converters supply	Tp20	+15V	±0,5V	---
Tp20	0V2 analog and converters supply	GND	0V	---	---
Tp21	-15V2 analog and converters supply	Tp21	-15V	±0,5V	---

I&S					
B3	**description**	**ref. to**	**right value**	**range**	**format 1V=↓**
Tp1	0V1 supply	GND	0V	---	---
Tp2	V1 supply	Tp1	13,2V	±0,2	---
Tp3	Capacitors current signal (starter).	Tp1	5,8V*	9,4÷10VpK**	---
Tp4	Voltage reference for comparators of starter currents.	Tp1	7,9V	±0,3	---
Tp5	Virtual ground for AC amplifier IC1(LM324)	Tp1	6V	±0,5	---
Tp6	Main current signal (starter).	TP1	5,8V*	9,4÷10VpK**	---
Tp7	0V1 supply	GND	0V	---	---

* in stand by status
** in preparation

CHARGER					
B4	**description**	**ref. to**	**right value**	**range**	**format 1V=↓**
Tp1	+15V3 supply	Tp2	+15V	±0,5V	---
Tp2	0V3 supply	GND	0V	---	---
Tp3	-15V3 supply	Tp2	-15V	±0,5V	---
Tp4	Charger converter clock	Tp2	25kHz	± 200Hz	---
Tp5	Voltage reference safety circuit	Tp2	6,9V	---	100V
Tp6	(VC/100) Capacitors battery voltage / 100	Tp2	6,8V	0÷6,8V	100V
Tp7	(-Vc/50) Negative battery branch / 50	Tp2	-6,8V	0÷(-6,8)V	50V
Tp8	(+Vc/50) Positive battery branch / 50	Tp2	6,8V	0÷6,8V	50V

CHOPPER CONTROL					
B5	**description**	**ref. to**	**right value**	**range**	**format 1V=↓**
Tp1	0V3 supply	GND	0V	---	---
Tp2	set Vout (370V)	Tp9	-7,5V	---	50V
Tp3	set Iout Max (55A)	Tp9	-5,5V	---	10A
Tp4	Error amplifier output signal (High=IGBT max conduction)	Tp9	---	0÷15V	---
Tp5	PWM clock for Chopper regulation	Tp9	20kHz	---	---
Tp6	Chopper voltage feedback	Tp9	7,5Vmax	0÷7,5V	50A
Tp7	+15V3 supply	Tp9	+15V	±0,5V	---
Tp8	Chopper current feedback	Tp9	5,5Vmax	0÷5,5V	10A
Tp9	0V3 supply	GND	0V	---	---
Tp10	-15V3 supply	Tp9	-15V	±0,5V	---
Tp13	0V3 supply	GND	0V	---	---
⚠⚠☠ DANGER 700V REFERRED TO GND ☠⚠⚠					
Tp11	⚠ 0Va supply for IGBT drive	floating	0Va	---	---
Tp12	⚠ IGBT drive signal	Tp11	---	±13,5V	---

FILAMENT					
B7	**description**	**ref. to**	**right value**	**range**	**format 1V=↓**
Tp1	Output DAC of mA SET	Tp9	7Vmax	1,9÷7V	20mA a
Tp2	Clock for Filament PWM regulation	Tp9	16kHz	---	---
Tp3	Output DAC of filament current set	Tp9	2,5Vst.by	2÷4V	---
Tp4	-15V2 supply	Tp9	-15V	±0,5V	---
Tp5	+15V2 supply	Tp9	+15V	±0,5V	---
Tp6	Input of ANODIC mA (feedback)	Tp9	7Vmax	0÷7V	20mA a
Tp7	Filament current set	Tp9	3,5Vst.by	0÷5V	100mA f
Tp8	Filament current feedback	Tp9	7Vst.by	0÷10V	50mA f
Tp9	0V2 supply	GND	0V	---	---
Tp10	0V2 supply	GND	0V	---	---
a= anodic f= filament					

INVETER CONTROL					
B11	**description**	**ref. to**	**right value**	**range**	**format 1V=↓**
Tp1	Tube kV (feedback signal)	Tp10	6,25Vmax	0÷6,25V	20kV
Tp2	kV set	Tp10	6,25Vmax	2÷6,25V	20kV
Tp3	Error amplifier clamp	Tp10	10V	0÷10V	---
Tp4	kV set clamp	Tp10	6,25V	---	---
Tp5	kV- feedback	Tp10	6,25Vmax	0÷6,25V	10kV
Tp6	kV+ feedback	Tp10	6,25Vmax	0÷6,25V	10kV
Tp8	Input of ANODIC mA (feedback)	Tp10	7Vmax	0÷7V	20mA
Tp9	+15V2 supply	Tp10	+15V	±0,5V	---
Tp10	0V2 supply	GND	0V	---	---
Tp11	-15V2 supply	Tp10	-15V	±0,5V	---

Fuses

Even if the mains plug is disconnected there may be dangerous voltage into the unit, if the capacitors battery is not discharged.

DO NOT PERFORM HAZARDOUS OPERATIONS
ELECTRIC SHOCK DANGER

Board	Fuse	Value	Function
S1 **Power Supply +V1**	F1	3,15A -T	Power supplier input protection (mains voltage).

Board	Fuse	Value	Function
S2 **Power Supply ±V2, Vm, Vd**	F1	10A -T	Power supplier input protection (12V1).

Board	Fuse	Value	Function
B3 **on/off starter collimator**	F1÷F2	4A - T	B3 board output / charger supply protection (mains voltage).
	F3÷F4	4A - T	Starter protection (mains voltage).
	F5	500mA - T	Ignition circuit protection (12V1).
	F6	10A - T	Collimator protection (12V1).

Board	Fuse	Value	Function
B4 **Charger ±V3 Supply**	F1	250mA - T	15V3 supplier input protection (mains voltage).
	F2	4A - T	Charger inverter circuit protection (320VL).

Board	Fuse	Value	Function
Capacitors Battery	F1÷F6	20A Extra Fast	Capacitors protection (one fuse for every capacitor) (Vc).

Board	Fuse	Value	Function
B6 **Chopper**	F1÷F2	63A Extra Fast	Chopper output protection.

Board	Fuse	Value	Function
B7 **Filament**	F1	1A - T	Filament board input protection (320VL.).

Jumpers

During the standard working phase every Jumper (JP) has to be set in “a-c” position.
The “b-c” position is devoted to the options enablation, or to make the faults finding easier.

Charger	
Label	**Description with “b-c” position**
B4-JP1	It is possible to check +15V3 supply without load.
B4-JP2	It is possible to check -15V3 supply without load.
B4-Jp3	It limits capacitors battery load to 400V instead of 680V.

Filament	
Label	**Description with “b-c” position**
B7-Jp1	Only for test. Aimed to check the relation between the filament current and anodic current. It allows the exposure without the automatic correction of the anodic current.
B7-Jp2	Only for test. It allows the manual set of filament current by B7-P2 trimmer. WARNING. Set the current according to the tube emission curves. DO NOT PERFORM EXPOSURE IF B7-TP3 VOLTAGE IS NOT COMPRISED BETWEEN 3V AND 3,5V!
B7-Jp3	Only for test. It allows the manual setting of the anodic current through B7-P4 trimmer. WARNING. Set the current value according to the tube loading curves; 1V measured in B7-Tp1 corresponds to 20 anodic mA (Max 7V=140mA).

HS BOARD	
Label	**Description with “b-c” position**
B8-Jp1	It enables the manual selection between Handswitch and IR Remote Control. If IR Remote Control option is not available set this jumper in “a-c” position.

Relays

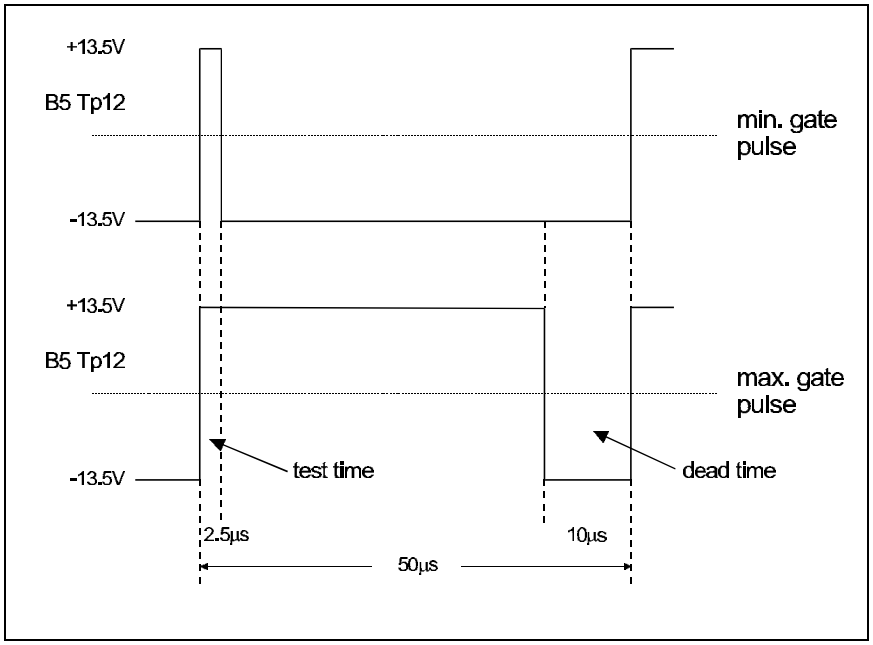
Board	Relay	Function
B2 **MPB**	K1	It is driven by the hardware safety circuit (V2 OK, CPU RUNNING, MAX XR TIME). A contact (12V1) breaks the supply to the Handswitch and to the Starter controls, the other contact (+15V3) breaks the supply to the Charger controls.
	K2	It is in parallel connected to K1 relay, breaking the inverter and the filament supply (15V2).
	K3	It is excited by the X-ray preparation request (HS PRE). Its contact breaks the STARTER RUN signal.
	K4	It is excited by the exposure request (HS RAD), while unexcited with a 100ms delay. Its contacts break XR ENABLE, XR ORDER, mA STABILIZATION signals.

Board	Relay	Function
B3 **On/off Starter Collimator**	K1	Mains supply relay. Controlled by the ignition circuit.
	K2	This relay is excited when mains voltage is 230V. It changes the gain of the reading circuit of the anode stator currents.
	K3	It is excited by the STARTER ENABLE signal. It's excited in run time and brake time conditions of the anode. It's driven so that its contacts close and open when B4-TH1 and TH2 triacs are OFF (zero power switch).
	K4	It is excited by the LAMP REQUEST button or by infrared Handswitch. It generates the LAMP ORDER signal.

Board	Relay	Function
B7 **Filament**	K1	Usually it is excited to supply the filament, while unexcited when the filament current is higher than the max. allowed value.
	K2	It is excited during X-ray emission by mA STABILIZATION signal.

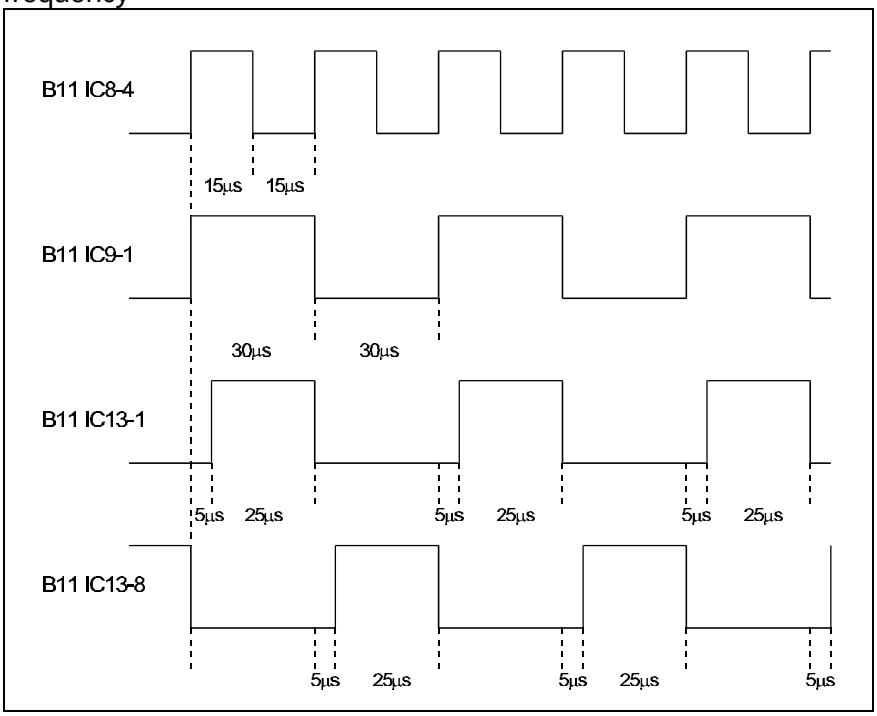
Timing diagrams

Chopper IGBT driver



Inverter IGBT drivers

Maximum work frequency



CAPACITORS BATTERY

Description

(refer to electrical drawings)
The capacitors battery is composed by 12 capacitors (17.000µF - 350V) in serial-parallel connected to supply a ±340V GND referred voltage (680V voltage to battery leads). The battery is divided into 2 smaller groups, each one of 6 capacitors in serial-parallel connected.
Every capacitor is protected by an extra-fast fuse, in order to break the current in case of short circuit of a battery element. The charging status of every capacitor is monitored by a green led (Ld1÷Ld6) in parallel connected; the led is ON only if the capacitor voltage is > 280Vdc, otherwise it will be OFF.
Green leds B4-Ld3 and B4-Ld4 indicate the voltage present to the capacitor leads of the whole battery, until a minimum voltage of +35V for the positive branch, and of -35V for the negative one. When leds are OFF the battery voltage is comprised between 70V and 0V.
The pressure of the red button PB1 placed on the B4 board trigs the forced discharge of the battery on the R1 high power resistor (80Ω - 150W). It's possible to trig this operation also if the unit is OFF, by only if the battery voltage is > 55V. More details are listed here below:

Vbat (V)	+Vc (V)	-Vc (V)	Luminosity B4-Ld3 (+Vc) e B4-Ld4 (-Vc)	Capacitors discharge trig
70	+35	-35	well visible	sure
60	+30	-30	less visible	
56	+28	-28	OFF	
45	+23	-23		non sure
40	+20	-20		interdicted

It's also possible to trig the capacitor discharge by keyboard, in SERVICE MODE → DIAGNOSTIC menu → CAPACITORS option.

If the capacitors battery is not completely discharged, even though the mains plug is disconnected, a dangerous voltage inside the unit might be present.

Charging time

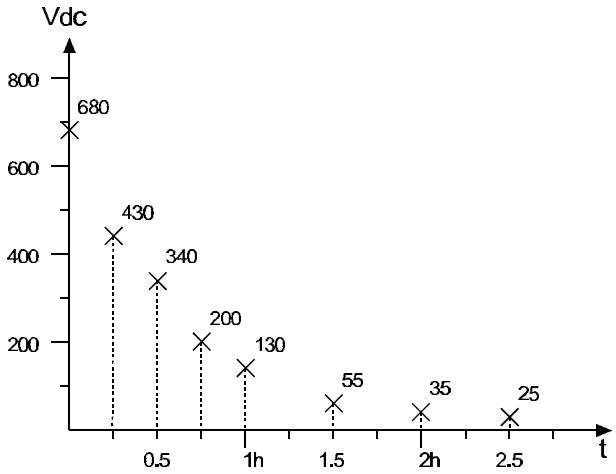
Capacitors battery charging times are the following:

With 230V or 115V mains	
From 0V to 680V	~80s
From 300V to 680V	~45s

Natural discharging time

By the unit turning OFF the batteries naturally discharge in high impedance circuits. In this case approx. 3 hours are needed.

time [h]	voltage [Vdc]
0	680
¼	430
½	340
¾	200
1	130
1 ½	55
2	35
2 ½	25



Forced discharging time

By the forced discharge times decrease at approx. 30s.

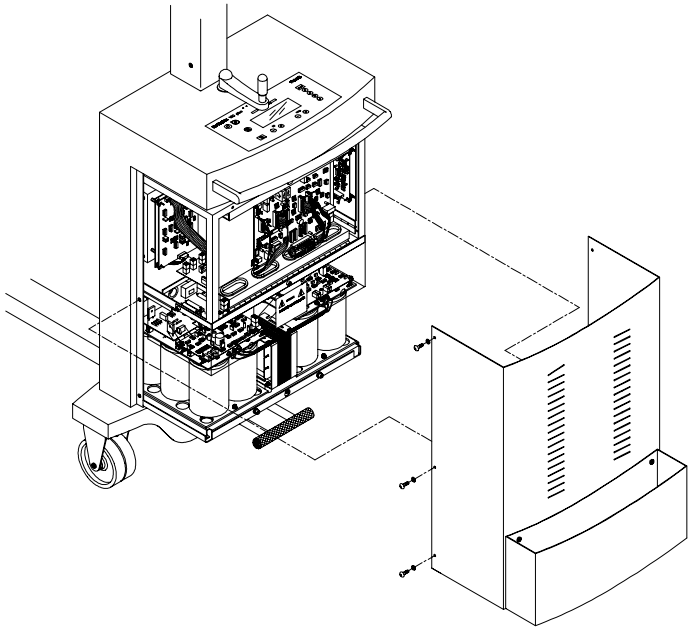
from	to	time
680Vdc	230Vdc	5s
	100Vdc	10s
	25Vdc	15s
	0Vdc	30s

Before operating on capacitors make sure, by a voltmeter, that voltage to their leads is lower than 15V.
Never directly short-circuit the capacitors poles. The residual voltage and high capacity may release very dangerous currents.

Capacitors discharge procedure

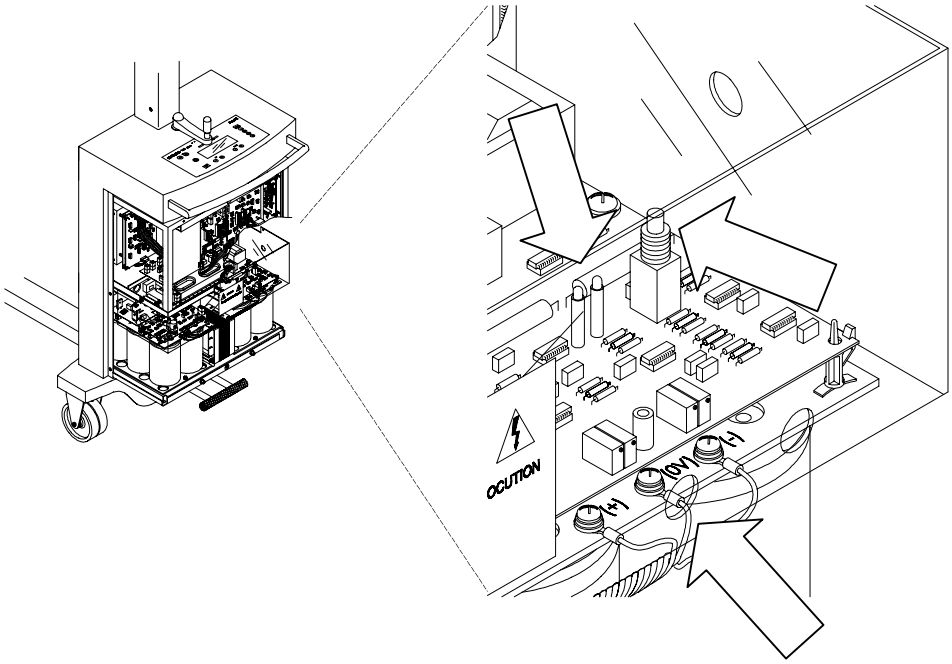
NEVER PERFORM HAZARDOUS OPERATIONS.
ELECTROSHOCK DANGER.
If the capacitors battery is not completely discharged, even though the ma
plug is disconnected, a dangerous voltage inside the unit might be present.
Before removing the Plexiglas protection and/or performing any operation on
Capacitors Battery, Power Unit, Inverter Power Circuits and Monobloc trig
forced discharge.
To ensure that each capacitor battery is discharged (V<15) perform a volt
measurement by means of a voltmeter.

1. For the battery discharge 2 different procedures are foreseen:
   In SERVICE MODE → DIAGNOSTIC menu → CAPACITORS option (see the chapt. "Service information"). The capacitors battery voltage is shown on display.
   OR:
   By the pressure of the PB1 red led placed on the B4 board inside the unit. The discharge can be performed in any moment even with the unit OFF, but only if the battery voltage is > 55V. To get access to the button remove the 6 screws placed aside and remove the cover.



Warning: from now on, parts under voltage are accessible

2. By the use of a tool that guarantees a proper isolation (i.e. an isolated screwdriver or a plastic pen) press the red button for the discharge, through the hole located aside the Plexiglas protection. **ABSOLUTELY AVOID accidental contacts on the board components.**



3. Before removing the Plexiglas protection:
   1. Wait until the Ld3 and Ld4 leds are completely OFF (V<70), if needed decrease the environmental luminosity.
   2. Wait for 1min. more.
   3. Then, by the means of a voltmeter and through the holes placed in front of the Plexiglas protection, measure the voltage between poles (+) and GND as well as GND and (-). The battery is totally discharged only when, in all cases, voltage is <15V.

Never directly short-circuit the capacitors poles. The residual voltage and high capacity may release very dangerous currents

DOCUMENT STATUS

Rev.	*Date*	*Page/s*	*Modification description*
0			Document approval
1			
2			
3			
4			
5			

PRACTIX 100 PLUS
SERVICE INFORMATION

[File: W3016_Rev0.doc]

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SERVICE INFORMATION CHECKLIST

The following two tables are useful for Service, so that all the information about the technical interventions during the life time of the unit can be recorded.

Unit: Practix 100 plus	Type Nr.:
Date of installation:	S/N:

N-Sheet Nr. Service-Information Nr.	Implemented		Remark
	Date	Signature	

N-Sheet Nr. Service-Information Nr.	Implemented		Remark
	Date	Signature	

SERVICE TOOLS

Required tools and measuring devices for Repairing & Maintenance

Mechanical

Metric standard tools (screwdrivers, etc...)

Electrical

Digital Multimeter ..... type Fluke 87 or equivalent
Digital storage oscilloscope ..... type Philips PM 3365A or equivalent

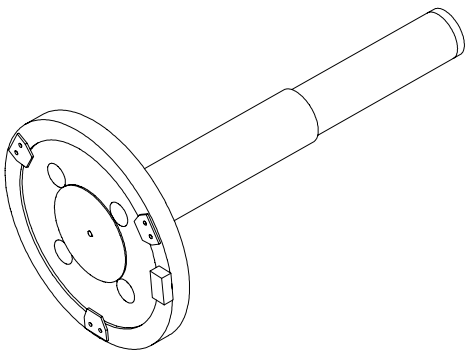
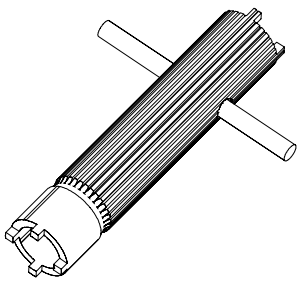
Radiological

mAsmeter ..... type Philips PM 2618/32 or equivalent
Not invasive kV and Time meter ..... type RTI MINI-X plus or equivalent

Electrical safety

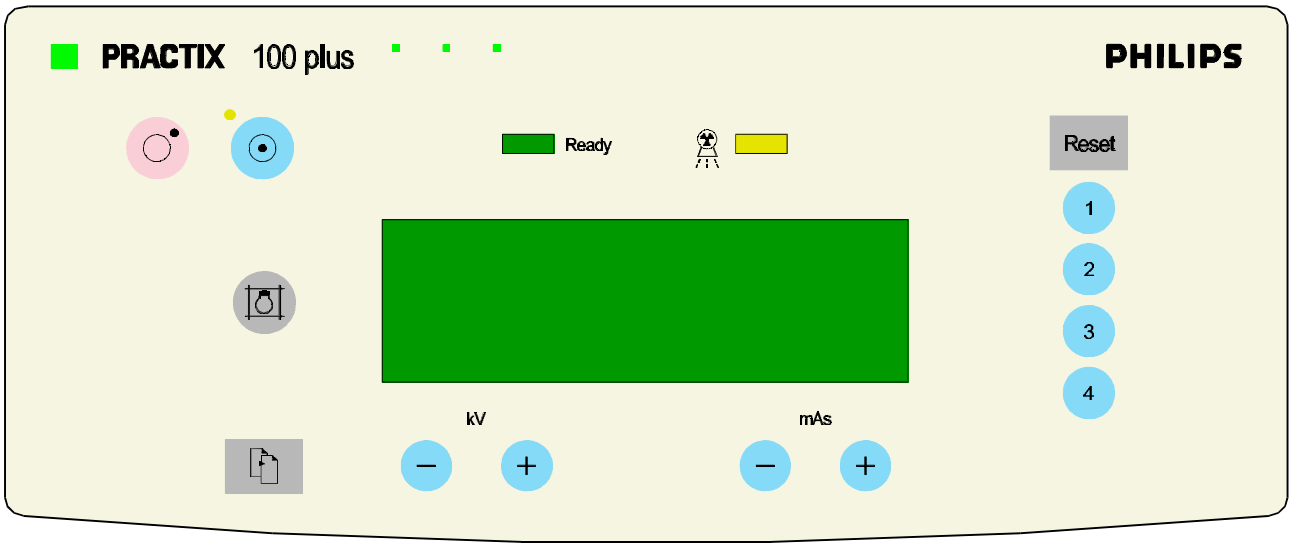
Leakage current meter ..... type Bender 1000ST or equivalent
Protective ground wire tester ..... type Bender 1000ST or equivalent

Special tools

tool	description	TX code	12NC
Collimator centering tool.		---	4522-980-31521
Key for the arm and monobloc clutches adjustment.		52662	4512-590-23961

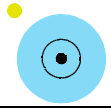
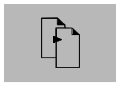
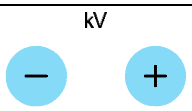
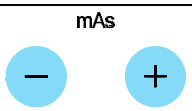
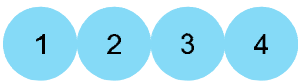
KEYBOARD DESCRIPTION

Here follows a general view of the unit keyboard.



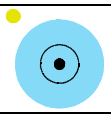
Buttons

Here follows a short description of the buttons function, in normal use, and the signals meaning. While operating, remember that in SERVICE MODE (SM) some buttons have different functions according to the use, therefore operate carefully!

	ON	Unit on, the yellow led indicates that the unit is connected to the mains and supplied
	OFF	Unit OFF
	COLLIMATOR	Collimator lamp lighting up (timed for about 30s)
	MENU	It allows the pages shifting in menu composed by several pages
	kV+ kV-	Possibility to modify the kV value
	mAs+ mAs-	Possibility to modify the mAs value
	RESET	Return to the upper menu
	F#	Functions key: F1, F2, F3, F4 They often refer to the nr. of the display line. (4 lines display)

Luminous signals

Here follows the list of the luminous signals present on the unit:

	POWER	The yellow led placed aside the ON key indicates that the unit is connected to the mains and supplied.
	READY	ON anytime that the unit is ready for radiography.
	X-RAY	The lighting up of the led indicates X-ray emission.

It is not possible to disenable the luminous signals.

Acoustic signals

Here below the list of the most important acoustic signals:

2 BEEP	Memorization performed
3 BEEP	X-ray emission OK
1 BEEP LONG	Alarm, bad-functioning

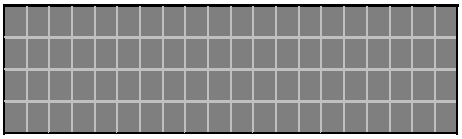
It is possible to disenable the acoustic signals. (see the next pages).

IGNITION AND START UP

The Start up is the phase between the unit turning ON and the “READY” message. In this phase diagnostic and functioning tests are performed, and the capacitors battery is charged.

To turn the unit ON, proceed as follows:

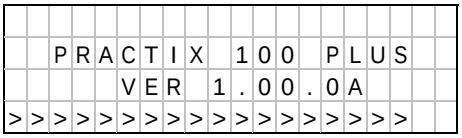
1. make sure that unit is connected to the mains and that the magneto-thermic switch is ON (ON position);
2. make sure that yellow led placed aside the POWER button is ON, this means that the unit is properly supplied;
3. press the POWER button;
4. start up sequence description:
   4.1. display check: every digit is completely ON (all the pixels are dark);



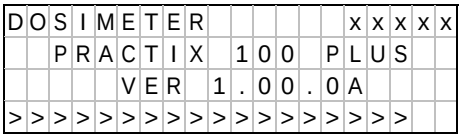
   4.2. leds and beeper check: all the leds on the keyboard turn on and the beeper emits a long sound;

   4.3. software version:

- without dosimeter



- with dosimeter



xxxxx: can be ACTIVE, INACTIVE, NOT OK

   4.4. battery charging phase: the capacitors are charged and the unit is ready to perform X-ray when the 4th line bar shows 18 “>” symbols; the number of the “>” symbols is proportional to the capacitors voltage. Every “>” is equivalent to about 35V (i.e.: “>>>>” is equivalent to 140V).

5. After the Start up phase the display shows the “READY” message and the READY led is on. If faults are detected the display will show one of these error messages:

Display	Meaning	How to proceed		
CONFIG.	Wrong unit configuration or not performed	Call service	F	
HAND SWITCH ERR	Faulty x-ray hand switch	Try again, if error persists call service	F	R
ERR. TUBE CALIB. CALL SERVICE	Tube calibration error	Call service	F	R
TUBE SEASONING	After a long period of un-use (3 months or more) it’s necessary to perform the setting-in of the X-ray tube, in order to avoid any damage	Press RESET and continue, call service for tube setting-in	W	R
CLOCK OFF	Clock system fault	Press RESET and continue	W	-
RESET APR	APR checksum fault	Press RESET and continue	W	-
POWER FAULT CALL SERVICE	Charger and chopper circuits fault Energy not available	Switch OFF, wait for some minutes, switch ON, if the error re-appears call service	F	R

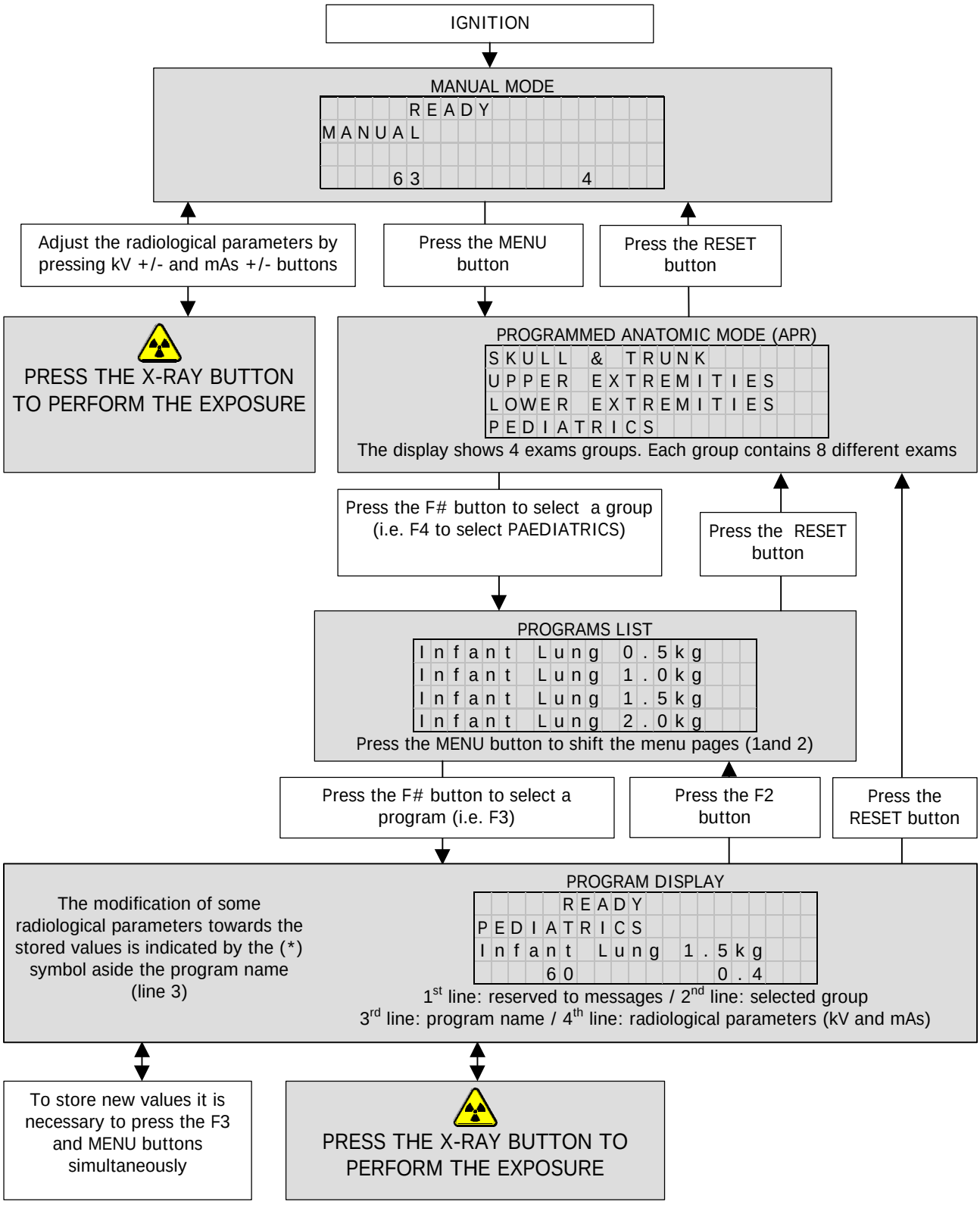
F = fatal error
W = warning
R = this message is stored in memory (menu ALARM)

English (GB)	German (D)	French (F)	Spanish (E)
CONFIG.	CONFIG.	CONFIG.	CONFIG.
HAND SWITCH ERR	HANDSCHALT. DEF	BOUTON DEFECT	FALLO MANDO
ERR.TUBE CALIB.	RÖHRE KALIBRIEREN	CALIB. DEFECT.	FALLO CALIB.
TUBE SEASONING	RÖHRE EINFAHREN	FORM. DU TUBE	ADJUSTE DEL TUBO
CLOCK OFF	TAKTGEBER DEFEKT	CHRONO DEF.	FALLO RELOJ
RESET APR	APR-DATEN DEFEKT	INI. APR	INI. APR
POWER FAULT	STROMVERSORG.DEF	BAT. DEFECT.	FALLO ACUMUL.

NORMAL FUNCTIONING

This part of the manual briefly describes the operations to be performed in the normal unit use. Since it contains useful information for the assistance, it is advisable to read it completely.

Operative Procedure


IGNITION
MANUAL MODE
READY
MANUAL
63 4
Adjust the radiological parameters by pressing kV +/- and mAs +/- buttons
Press the MENU button
Press the RESET button
PRESS THE X-RAY BUTTON TO PERFORM THE EXPOSURE
PROGRAMMED ANATOMIC MODE (APR)
SKULL & TRUNK
UPPER EXTREMITIES
LOWER EXTREMITIES
PEDIATRICS
The display shows 4 exams groups. Each group contains 8 different exams
Press the F# button to select a group (i.e. F4 to select PAEDIATRICS)
Press the RESET button
PROGRAMS LIST
Infant Lung 0.5kg
Infant Lung 1.0kg
Infant Lung 1.5kg
Infant Lung 2.0kg
Press the MENU button to shift the menu pages (1and 2)
Press the F# button to select a program (i.e. F3)
Press the F2 button
Press the RESET button
The modification of some radiological parameters towards the stored values is indicated by the (*) symbol aside the program name (line 3)
PROGRAM DISPLAY
READY
PEDIATRICS
Infant Lung 1.5kg
60 0.4
1st line: reserved to messages / 2nd line: selected group
3rd line: program name / 4th line: radiological parameters (kV and mAs)
To store new values it is necessary to press the F3 and MENU buttons simultaneously
PRESS THE X-RAY BUTTON TO PERFORM THE EXPOSURE

Notes

- Start up test sequence:
  1. display check;
  2. leds and beeper check;
  3. software version;
  4. capacitors loading: the unit is ready when the bar on the 4th line of the display is complete, it's necessary to remind that the ">" symbols number is proportional to the capacitors voltage, every ">" is equivalent to approx.35V (i.e.: ">>>>" equivalent to 140V).
- Only if the display shows "READY" and the READY led is on, it is possible to perform an exposure.
- The 1st line of the display shows the use messages and the error signals.
- The 4th line of the display shows the radiological parameters.
- After every exposure the 4th line shows the radiological parameters and, in the middle, the exposure time.
- When shifting from the APR MODE to the MANUAL MODE the radiological parameter will not change.

SERVICE MODE

This chapter provides a detailed description of the SERVICE MODE (=SM).

What is the SERVICE MODE?

The SERVICE MODE (SM) is a special menu procedure actionable from the Service assistance staff only. This procedure is necessary to set the working parameters and to easy the whole diagnostic phase as well as the faults finding. Most of these operations can be performed with the closed cover. SM allows an easy operating but, overall, with an optimal safety level.

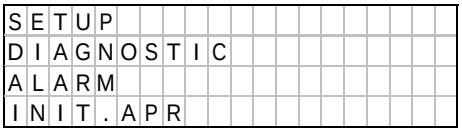
Activation/deactivation of the SERVICE MODE

It is possible to enter the SM only during the unit Start up phase, while to quit, turn the unit OFF. In any case it is not possible to enter the SM mode from the Normal Mode, as well as to shift from the SM to the Normal Mode without turning the unit OFF.

To activate the SM it is necessary to turn the unit ON by pressing the ON button (if the unit is already on, turn it OFF, wait for some seconds and then turn it on again), press the MENU and RESET buttons simultaneously before the end of the display check, until the “SERVICE CODE:” message is displayed. Now, press mAs+ and mAs- buttons and achieve the code 56 (prefixed activation code, set in the manufacturing phase and not modifiable!) then, press the MENU button to activate the procedure. If a wrong code has been set, the unit automatically shifts to the Normal Mode; in this case, to activate the SM, it is necessary to turn the unit OFF and repeat the procedure from the beginning.

Main Menu

If the whole procedure has been properly performed, the display shows the SM main menu.

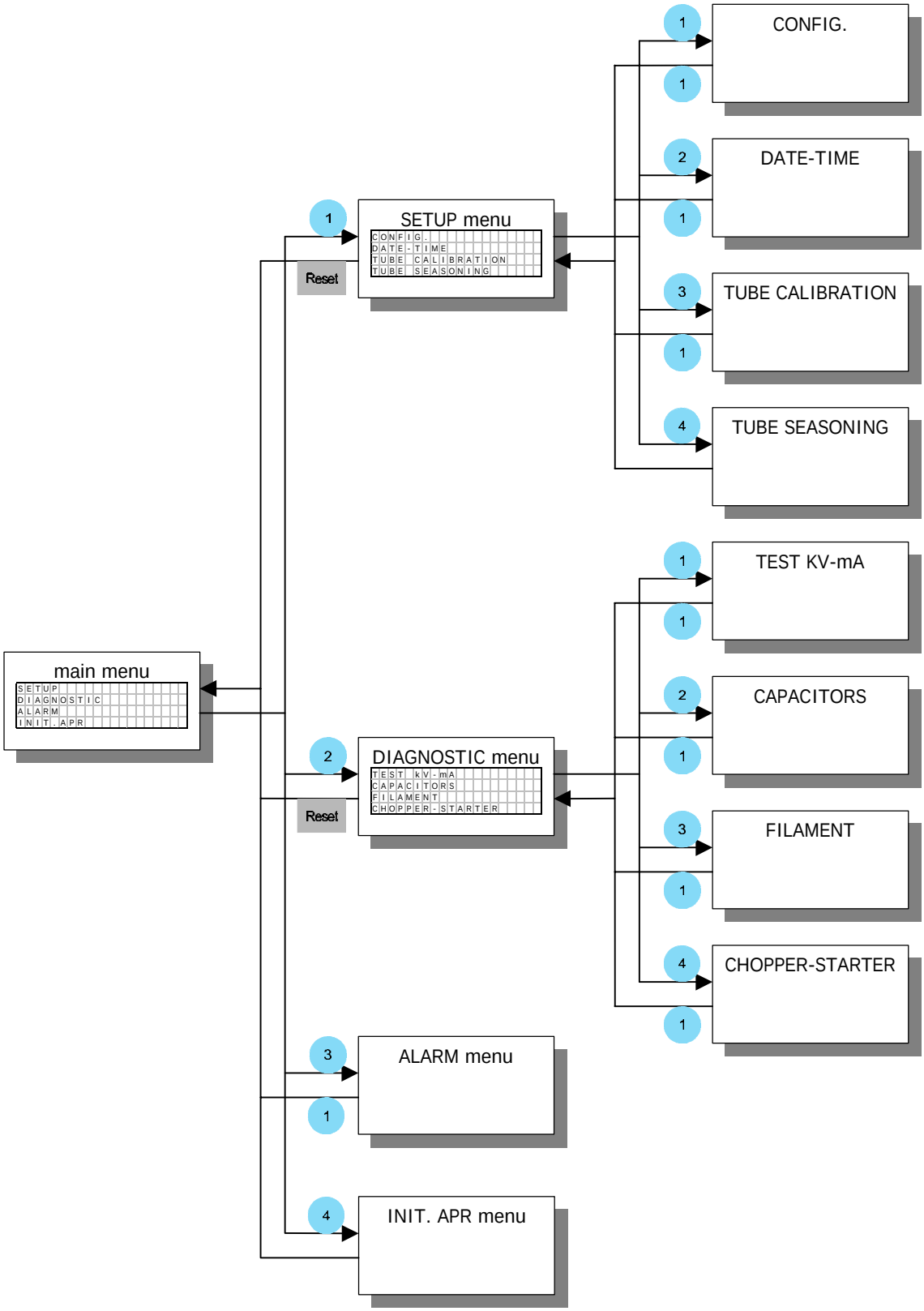


The three items can be activated by the pressure of the corresponding button F# (i.e. to choose the ALARM item it is necessary to press the F3 button). The following paragraphs describe in detail the functions and options of each item.

1	Access to the SETUP item pressing the F1 button from the main menu.
2	Access to the DIAGNOSTIC item pressing the F2 button from the main menu.
3	Access to the ALARM item pressing the F3 button from the main menu.
4	Access to the INIT.APR item pressing the F4 button from the main menu.

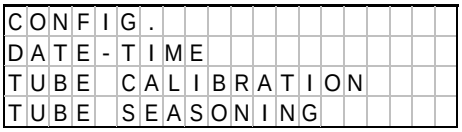
Menu reference guide

It is possible to shift through the several items of the menu by using the keyboard as follows:



menu SETUP: unit setting

The SETUP allows the setting and adjusting of all the configurable parameters like, for instance, the used language. The pressure of the F1 button enters this function from the main menu.
Upon the activation, the display is as shown here below:



To return to the main menu, press RESET.

CONFIG: data management of unit configuration

This function enables the unit adaptation to some eventual requests without performing any software modifications.

The configuration change must be performed by qualified staff only.

The CONFIG. item is entered by pressing the F1 button from the SETUP menu.
Upon the activation, the display is as follows:

1	/	3			C	O	N	F	I	G	.								
M	A	X	.	K	V									1	2	5		<	
S	T	A	R	T		K	V								6	3			
S	T	A	R	T		m	A	s								4			

By pressing the kV+ or kV- buttons it is possible to shift the menu pages.

2	/	3			C	O	N	F	I	G	.								
L	A	N	G	U	A	G	E							E	N	G		<	
A	P	R		m	e	m	.								O	N			
S	T	A	R	T	E	R		B	R	A	K	E			O	N			

3	/	3			C	O	N	F	I	G	.								
D	O	S	I	M	E	T	E	R							O	N		<	
B	U	Z	Z	E	R										O	N			

1	The CONFIG. item is entered by pressing the F1 button from the SETUP menu.
	To shift through the parameters list, press the MENU button. The “<” symbol on the right indicates the selected parameter.
kV − +	The kV+ button allows the display of the next page of the menu; kV- button allows the return to the previous page.
mAs − +	mAs+ and mAs- buttons increase or decrease the value of the selected parameter.
1	Return to the SETUP menu. If some parameters have been modified, it will be asked whether to store the modifications definitely or not. (F2 save, F3 not save)

Parameters

PAGE 1/3

1) **Max. kV:** this data allows the setting of the kV max. selectable value. The possible choices of the parameter are between 40kV and 125kV, in step of 1kV.

2) **Start kV:** this data allows the setting of the kV upon the ignition. The possible choices of the parameter are between 40kV and MAX.KV.

3) **Start mAs:** this data allows the setting of the mAs upon the ignition.

PAGE 2/3

1) **Language**: this data allows the selection of the language in which the unit displays the messages and indications in normal use. The SM is exclusively written in English language and is not modifiable.
Configurable languages are the following:

- English (ENG)
- French (FRE)
- German (GER)
- Spanish (SPA)

2) **APR mem.**: possible values are "ON" and "OFF". If "ON", the user can store new parameters in APR memory; if "OFF" the user can't store new parameters.

3) **Starter Brake** possible values are "ON" and "OFF". If "ON", the starter will be braked at the end of every exposure; if "OFF" the braking is exclusively linked to the internal frictions.

PAGE 3/3

1) **Dosimeter**: possible values are "ON" and "OFF". If "ON", the data of the dosimeter connected to the unit will be displayed; if "OFF" (or if un-present dosimeter) no data will be displayed.

2) **Buzzer**: possible values are "ON" (buzzer ON) and "OFF" (buzzer OFF).
Note: this option does not touch the optical signals (LED) at all.

How to operate:

Here follows the description on how to operate for the change of one data or more:

a) Choose the page (KV+ or KV- buttons) with the data to be modified.
b) Select the data and place, on the right of the value to be modified, the "<" symbol by the MENU button.
c) By means of the mAs+ and mAs- buttons, increase or decrease the value. The increase or decrease will stop once the data limit values are achieved.
d) Repeat the operations starting from:
- point b) to modify a further data in the same page
- point a) to modify a data that is not present in the selected page.

e) Press the F1 button to exit from the configuration phase. If any data has been modified, a further request for its memorization will appear. Press F2 button (YES) to store the new data or F3 (NO) to let the previous data.

DATE-TIME: unit watch setting

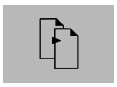
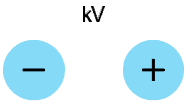
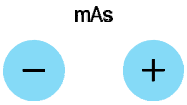
This option allows the unit watch setting. The unit utilizes this watch only during the data memory phase relating to errors.
To get access to the DATE-TIME item, press F2 button by the SETUP menu.
Upon the activation, the display is as follows:

1	/	2			D	A	T	E	-	T	I	M	E						
D	A	Y														0	3		<
M	O	N	T	H												0	3		
Y	E	A	R											1	9	9	9		

By pressing the kV+ button it is possible to shift to the second page of the menu:

2	/	2			D	A	T	E	-	T	I	M	E						
H	O	U	R	S												1	0		<
M	I	N	.													2	9		

By pressing the kV- button it is possible to return to the first page:

	To get access to the DATE-TIME item, press the F2 button by the SETUP menu.
	To shift through the parameters list press the MENU button. The “<” symbol on the right indicates the selected parameter.
	The kV+ button allows the display of the second page of the menu; the kV- button allows the return to the first page.
	mAs+ and mAs- buttons increase or decrease the value of the set parameter.
	Return to the SETUP menu.

TUBE CALIBRATION

This option enables the calibration procedure of the X-ray generator. The generator has to be calibrated every time that some parameters have changed.

The calibration phase is very important. It is COMPULSORY to strictly follow the procedure here described, in order to avoid the unit bad-functioning. It is necessary to CAREFULLY READ this part of the manual in order to prevent from any unpleasant consequences.

Warning: X-ray presence, use proper protections.

To get access to the TUBE CALIBRATION item, press the F3 button by the SETUP menu.

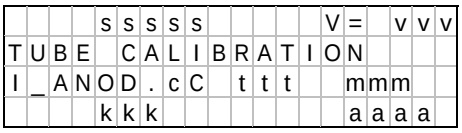
3	To get access to the TUBE CALIBRATION item, press the F3 button from the SETUP menu.
	To shift from the low mA curve calibration (MODE2) to the high mA one (MODE1), and vice-versa, press the MENU button.
kV − +	kV+ and kV- buttons allow the increase or decrease of the set kV value with step of 10kV.
mAs − +	mAs+ and mAs- buttons allow the increase or decrease of the set value of filament mA.
1	Return to the SETUP menu.

- **Cold-tube adjustment.**

The following pages better describe the calibration procedure.

Display description

In this phase, the display shows the following:



Therefore:

sssss Unit status, the following values can be shown:
- "READY": the unit is ready for X-ray exposure.
- "BUSY": the unit is busy, it is not possible to make an exposure.
- error messages: it is absolutely necessary to solve these errors before any operating.
- no message: voltage to the capacitors battery leads is not sufficient.

vvv Voltage measured at the capacitors battery leads, this value is updated in real time, step by step.

cc It can be "HI" or "LO" and indicates which curve is in calibration phase (high mA curve or low mA curve). Usually, it is advisable to calibrate the low curve first, then the high one. To shift from one curve to the other press the MENU button.

ttt Value of the reference anodic current. The aaaa value is correct when the mmm measured value is equal, or a little lower, (advisable at more than 2mA) than the ttt value.

mmm Value of measured anodic current. This value appears only after the exposure.

kkk Voltage applied to the X-ray generator.

aaaa This value approx. corresponds to the filament mA value multiplied per 10, it is modifiable from 3000 (≈300mA) to 5000 (≈500mA) by pressing the mAs+ and mAs- buttons. If this value is modified, the mmm value of the next exposure is also modified.

Correspondence between FIL DAC OUT - FIL CURRENT - ANODICAL CURRENT

The dac output, which determines the filament current, can be selected between 3000 and 5000 points. Every dac point corresponds to 1mV.
The TUBE CALIBRATION procedure automatically suggests the following points:

mA low curve (5,5kW)		
kV	mA	out dac (points)
40	70	4170
125	37	3860

mA high curve (11kW)		
kV	mA	out dac (points)
40	140	4460
125	75	4080

A 10 points variation (increase or decrease) corresponds to a 1mA variation of the filament current and to approx. a 2mA variation of the anodical current value in the tube.

Here below, as example, the data detected during a calibration performed in factory.

Variances between the measured values and those here below are linked, usually, to differences of tubes.

mA low curve 40kV – 70mA		
out dac	FIL CUR	ANOD. mA
4170	421	67
4180	422	69
4190	423	70
4200	424	72
4210	425	75

mA low curve 125kV - 37mA		
out dac	FIL CUR	ANOD. mA
3860	381	34
3870	382	35
3880	383	37
3890	384	38
3900	385	80

mA high curve 40kV - 140mA		
out dac	FIL CUR	ANOD. mA
4460	451	131
.....	.....	.....
4490	454	138
4500	455	140
4510	456	142

mA high curve 125kV - 75mA		
out dac	FIL CUR	ANOD. mA
4080	403	70
4090	404	72
4100	405	75
4110	406	77
4120	407	79

Notes

Please, carefully read the following information!

- The calibration curve is calculated only using aaaa values obtained at 40kV and 25kV voltages. For this purpose it is advisable to operate very carefully, above all, in fixing the parameter value to these voltages. It is very important to perform exposures even at high voltages, this way, it happens the tube pre-formation which guarantees a higher precision in fixing the generator parameters.
- To obtain a more accurate calibration, it is advisable to perform exposures with all the voltage values, from 40kV to 125kV, step by step.
- **Cold-tube adjustment.**
- FIRST adjust the low curve (“LO”), THEN the high one (“HI”): this way the X-ray generator will not be subjected to shocks and excessive stress. (The values obtained will be more exact).
- The “*” symbol appears on the right of mmm (3rd line) when the obtained aaaa value is NECESSARY for the calibration curve calculation (appears at 40kV and at 125kV). When this symbol appears, press F3 to store the value obtained.
- The “*” symbol appears on the right of the 2nd line when both values of aaaa, necessary for the curve calculation (at 40kV and 125kV), have been stored. When this symbol appears, press F2 and wait for some seconds (≈5s) before calculating the new curve. The memorization of the new curve will be indicated by a double beep.

Calibration procedure

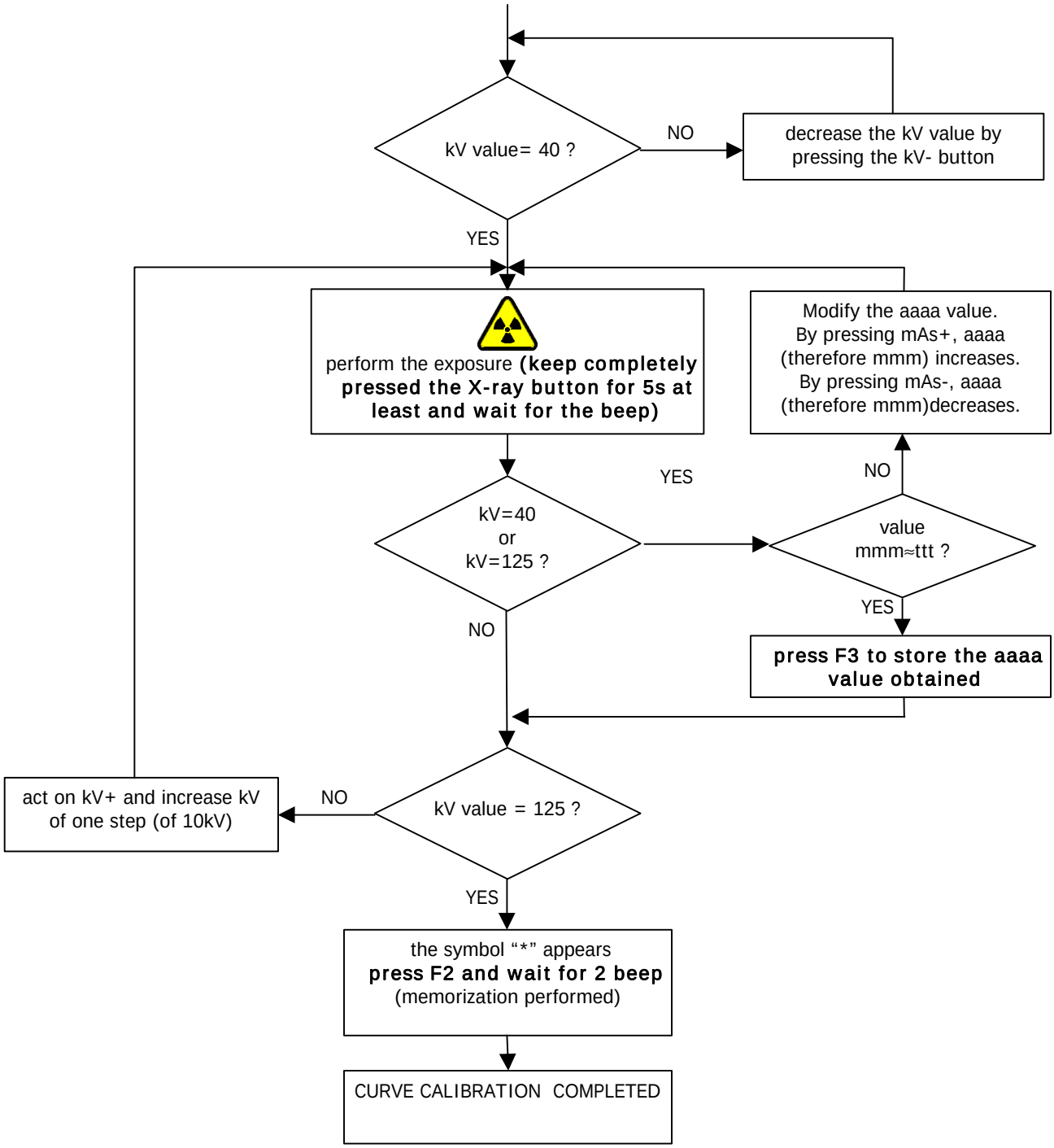
Calibrate the tube ONLY when cold The procedure is composed by two phases, which HAVE TO BE PERFORMED as follows:

1. X-ray generator adjustment with low curve (cc="LO", power 5.5kW, 50% of max. power applicable);
2. X-ray generator adjustment with high curve (cc="HI", power 11kW, max. power applicable).

Here below the description of the low curve (LO) calibration procedure.

Make sure that the low curve (LO) has been selected, if not, press the MENU button.

Follow the procedure as indicated in the flow diagram:


kV value= 40 ?
NO
decrease the kV value by pressing the kV- button
YES
perform the exposure (keep completely pressed the X-ray button for 5s at least and wait for the beep)
Modify the aaaa value. By pressing mAs+, aaaa (therefore mmm) increases. By pressing mAs-, aaaa (therefore mmm)decreases.
YES
NO
kV=40 or kV=125 ?
value mmm≈ttt ?
YES
NO
press F3 to store the aaaa value obtained
act on kV+ and increase kV of one step (of 10kV)
NO
kV value = 125 ?
YES
the symbol "*" appears press F2 and wait for 2 beep (memorization performed)
CURVE CALIBRATION COMPLETED

Then, the low curve is calibrated.
Now it is necessary to calibrate the high curve. (cc=HI).

Make sure that the high curve has been selected. (HI) If not, press the MENU button.

The procedure for the adjustment of the high curve is equal to the one for the low curve, therefore, follow the flow diagram previously shown.

Once this operation has been completed, it is possible to return to the SETUP menu, by pressing the F1 button.

Always remember to calibrate both curves before exiting the procedure.

Data storage time is about 5s long. Should the power supply be missing (for any reason) during this time, it is advisable to repeat the calibration procedure.

TUBE SEASONING

When is it necessary to perform the Warm-up and kV step-up cycle?

- After a period of unit un-use of 1 month or more.
- Before performing the tube seasoning, if cold.

When is it necessary to perform the tube seasoning?

- After every unit un-use of 3 months or more. The unit automatically indicates, by the message "Tube seasoning", the necessity of this procedure. Only qualified technicians can perform the tube calibration.

Tube seasoning procedure

Warning: X-ray presence, use proper protections.

4	To get access to the TUBE SEASONING item, press the F4 button from the SETUP menu.
1	Return to the SETUP menu.
3	To select a sub-procedure among *Warm*, *kVup* and *Seas*

"Tube seasoning" procedures composed by 3 sub-procedures:

- *Warm* or Warm-up cycle
- *kVup* or kV step-up cycle
- *Seas* or Seasoning

The anode starting and braking are performed by the program "Tube seasoning", in order to avoid:

- useless overheating and eventual damages to the stator inside the monobloc;
- useless heating inside the monobloc that limits thermal capacity.

For the **tube preparation** only perform:

- *Warm* (Warm-up)
- *kVup* (kV step-up)

For the **tube seasoning** perform:

- *Warm* (Warm-up)
- *kVup* (kV step-up)
- *Seas* (Seasoning)

kV, mA, mAs, parameters, number of exposures, pause between an exposure and next one are shown in the following tables.

During X-ray, check the high voltage and anodical current stability, by means of an oscilloscope connected to the B11 “Inverter control” board, as follows:

Ch A → Tp1 (kV feed) → 1V = 20kV
Ch B → Tp8 (anodic mA) → 1V = 20mA
GND → Tp10 (0V2)

If during the Seasoning anomalies and irregularities occur, it’s necessary to stop the procedure for 30min at least, then re-start from the beginning.

Once the seasoning is completed DO NOT perform exposures. Let the monobloc cool for 8 minutes.

Display description

In this phase, the display shows the following:

				s	s	s	s	s		i	i			V	=		v	v	v
T	U	B	E			S	E	A	S	O	N	I	N	G					*
S	e	q		e	e			E	X	P		n	n			p	p	p	p
				k	k	k			t	t	t	m	s			a	a	a	a

Therefore:

sssss Unit status, the following values can be shown:
- “READY”: the unit is ready for X-ray exposure.
- “BUSY”: the unit is busy, it’s necessary to wait for ii seconds before exposing again.
- error messages: it is absolutely necessary to solve these errors before any operating.

no message: voltage to the capacitors battery leads is not sufficient.

ii Waiting time (see following tables).

vvv Voltage measured to the capacitors battery leads. It’s value is update realtime step by step.

* This asterisc appears only when the unit requires the tube seasoning (“TUBE SEASONING” message appears), while it disapears only if the whole seasoning sub-procedure is performed.

ee It idicates the sequence number (see following tables)

nn It indicates how many exposures still have to be performed to complete the sequence (see following tables) in course.

pppp It indicates the selected sub-procedure among: *Warm*, *kVup* and *Seas*. To shift the sub-procedure press F3.

kkk kV value. During this phase it is not possible to modify this parameter because automatically set by the unit.

ttt Duration of the last exposure performed.

aaaa mAs value. During this phase it is not possible to modify this parameter because automatically set by the unit.

Tube seasoning tables

Warm **(Warm-up)**				
set data output			nr. of exposures	waiting time [s]
kV	mA	mAs		
80	60	25	8	11

kVup **(kV step up)**					
seq. nr.	set data output			nr. of exposures	waiting time [s]
	kV	mA	mAs		
1	80	60	0.5	2	2
2	90	58	0.5	2	2
3	100	55	0.5	2	2
4	110	45	0.5	2	2
5	115	42	0.5	2	2
6	120	40	0.5	2	2
7	125	38	0.5	5	2

Seas **(Seasoning)**					
seq. nr.	set data output			nr. of exposures	waiting time [s]
	kV	mA	mAs		
1	80	60	8	5	9
2	90	58	8	5	9
3	100	55	8	5	9
4	110	45	8	10	9
5	115	42	8	10	9
6	120	40	8	10	9
7	125	38	8	20	9

menu DIAGNOSTIC: diagnostic tests

The DIAGNOSTIC item contains a series of procedures useful to check the unit proper functioning. This section is entered by pressing the F2 button by the main menu. Upon the activation the display is as follows:

TEST kV-mA
CAPACITORS
FILAMENT
CHOPPER-STARTER

To return to the main menu press the RESET button.

TEST KV-mA: voltage test, filament and anodic current.

Warning: X-ray presence, use proper protections.

The TEST KV-mA item is entered by pressing the F1 button by the DIAGNOSTIC menu.
This test allows the monitoring of the kV curves path, as well as the anodic and filament current during an exposure.
The test performs 10 curve samplings (10ms between each sampling), starting from the instant decided by the operator, and supplies information about currents and voltages.
Before exposing the display will show the following information:

	sssss V= vvv
TEST	KV-mA
	kkk tttt

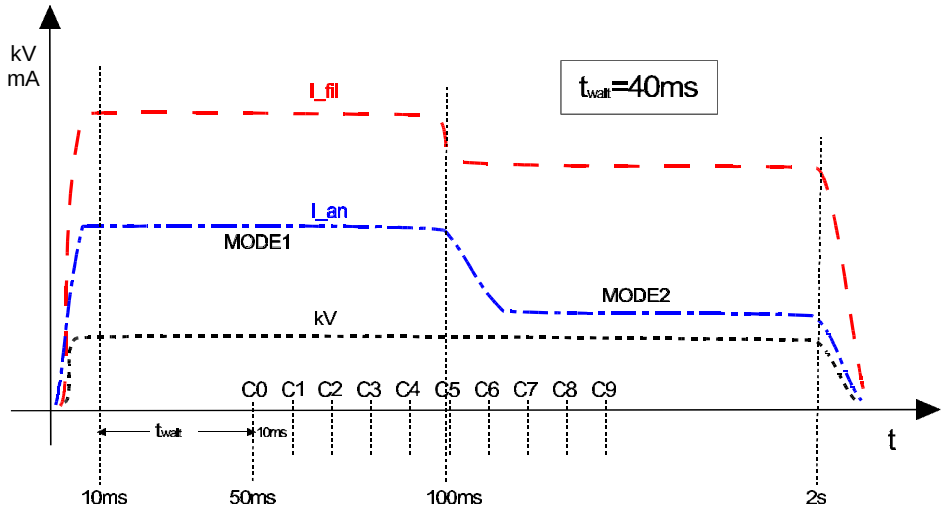
Therefore:

sssss Unit status, can have the following values “READY”, “BUSY”, no signal.

vvv Voltage measured to the capacitors battery leads.

kkk The set voltage between anode and cathode (modifiable by kV+ and kV- buttons).

tttt It is the t_{wait} parameter (see picture below).
It is the pause time between the exposure start (increased of 10 ms) and the 1st sampling C0, it can be adjusted between 0ms and 1800ms with step of 20ms by the mAs+ and mAs- buttons.
The #n sampling will be caught at the following moments: $t_{Cn}=10+t_{wait}+10*n$



The test procedure is the following:
1. Set the anode-cathode voltage (kV+ kV- buttons)
2. Set the t_{wait} parameter (mAs+ and mAs- buttons)
3. Perform an exposure. The "*" symbol will appear on the right of the 3rd line at the end of the exposure (only if the 10 samplings have been performed without problems).
4. Press the F3 button, shift the list of the acquired values, displayed as follows:

				s	s	s	s	s					V	=		v	v	v
T	E	S	T		K	V	-	m	A									
n		a	a	a					b	b	b				c	c	c	
					k	k	k							t	t	t	t	

The 1st , 2nd and 4th lines have the same meanings previously indicated; while on the 3rd line:

n Number of displayed sampling: (from 0 to 9)
Press F3 to see the next sampling
aaa Measured kV [kV]
bbb Measured filament current [mA]
ccc Measured anodic current [mA]

The test is ended. It can be repeated anytime. Upon every pressure of the X-ray control 10 new samples will be acquired.

With a series of following tests, by changing the value of t_{wait} of 100ms per time, it will be possible, interpolating the acquired data, to obtain an instantaneous of the whole voltage and of the currents curve (the max. time of exposure is of 2s).

This table shows the correspondence between kV and anodical current.

kV	Anodic current (I_an)		
	mAs>0,63		mAs<0,63
	(t<100ms) MODE1	(t>100ms) MODE2	MODE2
40	140mA	70mA	70mA
50	140mA	70mA	70mA
60	130mA	65mA	65mA
70	125mA	63mA	63mA
80	120mA	60mA	60mA
90	115mA	58mA	58mA
100	110mA	55mA	55mA
110	90mA	45mA	45mA
120	80mA	40mA	40mA
125	75mA	38mA	38mA

CAPACITORS: capacitors battery test

To enter the CAPACITORS battery item, press the F2 button by the DIAGNOSTIC menu.
This test permits to monitor the charging/discharging system of the capacitors and to perform some tests.
The display is as follows:

					C	A	P	A	C	I	T	O	R	S					
V	=	V	v	v			V	p	=	p	p	p			D	E	S	C	
C	H	A	R	G	E		E	N	A	B	L	E			x	x	x		
S	E	A	S	O	N	I	N	G							y	y	y		

Therefore:

vvv Real voltage to the capacitors battery, measured step by step.

ppp Peak voltage to the capacitors battery (the max. voltage to the battery from the CAPACITOR test activation). To reset the value, get out and return to the test.

xxx Possible values are “ON” and “OFF”. If “ON”, the capacitors battery loading system is active (voltage to the capacitors should not decrease), if “OFF” the loading system is not active (the capacitors should discharge).

yyy Possible values are “ON” and “OFF”. The forming procedure (SEASONING) of the capacitor battery is activated by pressing the F4 button. When yyy is ON it is not possible to activate the loading system manually (this means by pressing F3), because the seasoning process is active and performing a series of charges and discharges (voltage to the battery varies between 400V and 450V). For a proper capacitors battery seasoning it is necessary to perform this procedure for 2÷3 hours.

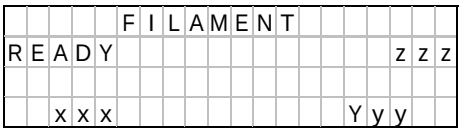
In case of malfunctioning of the capacitors management electronics the 1st line displays the “POWER FAULT” or “FAULT V3” messages, in function of the error type.

Buttons have the following functions:

1	Return to the DIAGNOSTIC item.
2	Activation of the capacitors battery discharging system. ATTENTION: once this button has been pressed, it is not possible to recharge the battery anymore. To re-activate the unit, turn it OFF and, after some seconds, turn it ON again.
3	Activation/deactivation of the charging system.
4	Activation/deactivation of the system for the capacitors battery seasoning.

FILAMENT: filament ignition and safety test

The FILAMENT item is entered pressing the F3 button, by the DIAGNOSTIC menu.
This test allows the filament ignition check.
The display shows what follows:



Therefore:

yyy Set filament current (I_{FIL} set), range from 100mA to 500mA
xxx Measured filament current (I_{FIL} real); it is proper if the difference between xxx and yyy is lower than ±20mA
zzz Indicating the presence or not of the READY signal (“ON” or “OFF”)
The READY signal can be as follows:

- “ON” if 220mA<I_{FIL}<480mA
- “OFF” if I_{FIL}>480mA or I_{FIL}<220mA

Buttons have the following functions:

1	Return to the DIAGNOSTIC item.
Reset	Turn OFF the filament quickly. I_{FIL} set→100mA
mAs − +	mAs+ and mAs- buttons allow the increase or decrease of the mA filament values set.

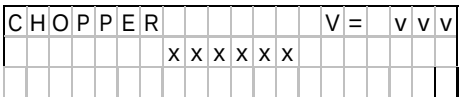
Do not set the filament current over 400mA for more than 2 minutes, not to break the filament.

CHOPPER-STARTER: chopper and starter test

The CHOPPER-STARTER item is entered by pressing the F4 button by the DIAGNOSTIC menu.
This allows the test of two unit components: chopper and starter.
It can be divided into two parts:

Chopper test

The upper part of the display shows the parameters for the chopper test:



Therefore:

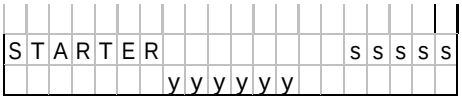
vvv Voltage at the chopper input $V_{CHOPPER\_IN}$
xxxxxx It can be "ENABLE", "READY ON" or "READY OFF"

The chopper test is performed in the following way:

1. Press and keep the F2 button to enable the chopper→on the 2nd line appears "READY OFF";
2. If everything is functioning properly, after 1s as max., "READY ON" appears ($V_{CHOPPER\_OUT}$>310V);
3. If READY ON does not appear maybe a fault to the chopper has happened.

Starter Test

The inferior part of the display shows the parameters for the starter test.



Therefore:

sssss Start time, it can change in function of the mains voltage V_{MAIN}=230→t_{START}=800ms, V_{MAIN}=115→t_{START}=1600ms)
yyyyyy It can be "ENABLE", "READY ON" o "READY OFF"

The starter test is performed as follows:

1. Press and keep the RX prep Handswitch until the test end;
2. Press and keep the F4 button to enable the starter→on the 4th line "READY OFF" appears;
3. If everything is functioning properly, within the start time (V_{MAIN}=230→t_{START}=800ms, V_{MAIN}=115→t_{START}=1600ms) "READY ON" appears:
4. If "READY ON" does not appear within the start time, maybe a fault to the starter has happened.

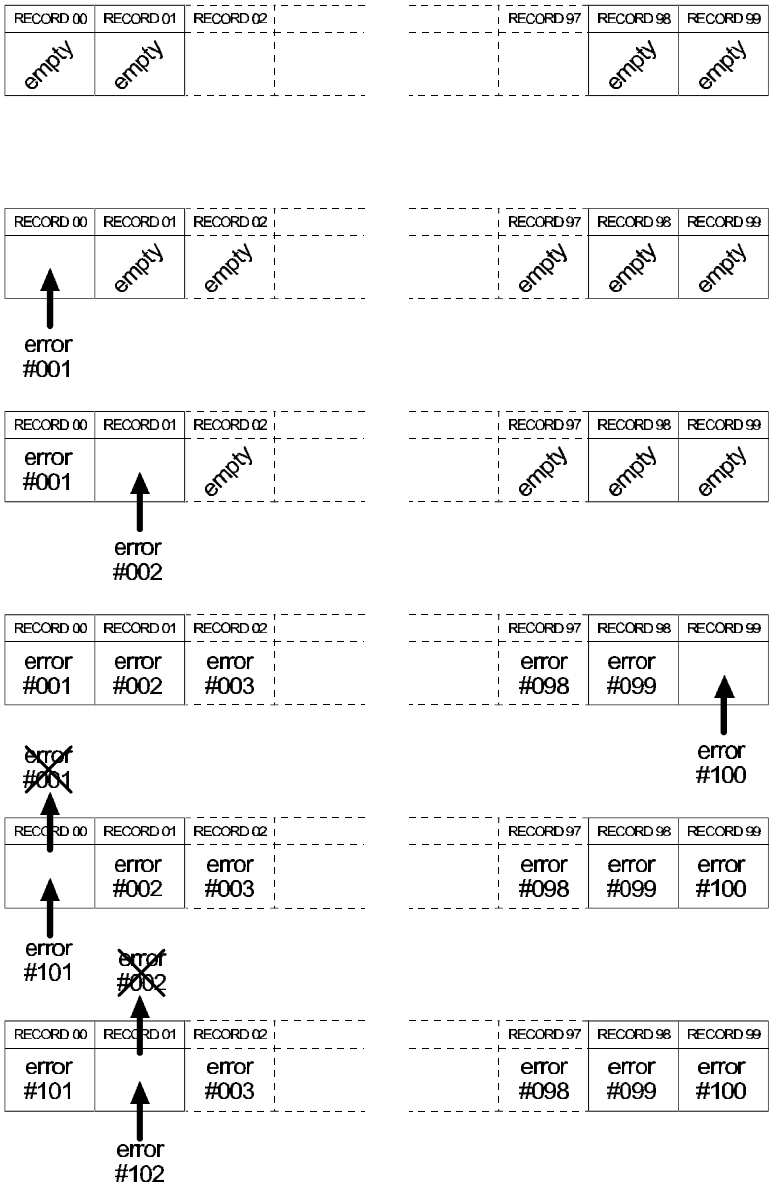
Buttons have the following functions:

1	Return to DIAGNOSTIC item.
2	Keep pressed, it enables the chopper functioning CHOPPER→ ENABLE
4	Keep pressed, it enables the starter functioning STARTER→ ENABLE

menu ALARM: alarm display

The ALARM item shows the list of all the anomalies detected during the unit use (like a “day-diary”); it is very useful in SERVICE MODE because allows the detection of the causes of some faults.

The list is a circular buffer (circular buffer - FIFO) and can include up to 100 records, this way it is always possible to verify the last 100 alarms.



3	To enter this item press the F3 button by the main menu.
kV − +	The list is shifted by pressing the kV+ (scroll-up) and kV- (scroll-down) buttons. The “END ALARM” message appears when the list is completed or the list is empty (no alarm has been detected)
	Return to the list beginning (oldest signaled alarm) pressing the MENU button.
Reset + 4	Pressing RESET and F4 simultaneously the content of the list is deleted. ATTENTION! The unit will not ask for the confirmation of this operation.
1	Return to the main menu.

Alarm type

Practix 100 plus foresees three types of alarm:

- Warnings (WARN)
- Errors (ERR)
- Fatal errors (FERR)

This file explains how to read the codes generated by a Warning, (WARN), an Error (ERR) or a Fatal Error (FERR).

Each of the above mentioned alarm can be activated, but not all of them allow the continuation of the operations in course.

In fact, while for Warnings (WARN) the only pressure of the RESET button allows the continuation of the operations in course (after the proper adjustments, of course) without consequences, for the Errors (ERR) or Fatal Errors (FERR) there are some differences:

- An error (ERR) always has consequences (stored with date, time, kV and mAs).
- Fatal errors (FERR) will not allow the continuation of the operations, obliging the operator to turn the unit OFF.

For the Unit Operator

The operator will receive a signal through a proper character string in the language configured on the unit (ENG, FRA, GER, and SPA). The string will explain the fault in function of the error type, except for those that require a technical intervention. In this case, besides the alarm explicative string, even a second string will be visualized and will refer to a technical service call.

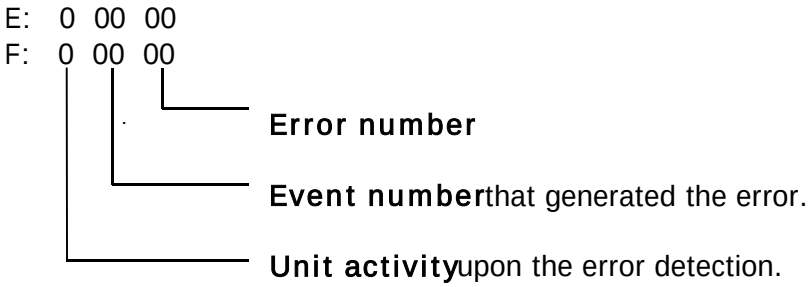
Stored alarms reading

All the stored alarms will be useful to the technician to detect the un-proper unit functioning, and therefore, to solve the problem as faster as possible.

The alarm will be composed by a prefix:

E: errors.
F: fatal errors.

The prefix will be followed by some digits (depending on the number of events) that have to be read as follows:



Display of the stored alarms

Each line will display an alarm as follows:

D	D	-	M	M	-	Y	Y	Y	Y		O	O	:	m	m				
a	:	C		E	E		N	N	-		K	K	K		A	A	A	A	

Therefore:

DD	Day tens and units
MM	Month tens and units
YYYY	Year thousands, hundreds, tens, units
OO	Hour tens and units
mm	Minutes tens and units
a	Alarm (F or E to indicate if Fatal Error, Error)
C	Act (unit activity upon the alarm, refer to table in the following pages)
EE	Tens and units of the event that generated the alarm (refer to table in the following pages)
NN	Alarm tens and unit number (refer to table in the following pages)
KKK	kV hundreds, tens and units
AAAA	mAs value (from 0.2 to 125)

The technician will see the alarms in pages composed by two alarms. It will be possible to display the stored alarms through the use of the kV+ and kV- buttons (scroll-up, scroll-down). Furthermore, it will be possible to return to the beginning of the list by the MENU button and delete all the stored alarms by the simultaneous pressure of RESET and F4 buttons. The "END ALARM" message indicates the end of the alarms or alarms lack. By the F1 button, it is possible to exit from the alarm display process.

Maybe, in Start up phase some alarms will indicate a kV value =0 and mAs=0.2, because in their testing phase these two parameters haven't been initialized yet.

Reference alarms tables

These tables allow the identification of the codes composing the error, thus to make them readable.

Reference activity table

C

Code Number	Activity
0	STARTUP Errors that can be detected between the ignition and STAND-BY phase, during the initialization and verifications of the data useful for the unit proper functioning. NOTE: In this phase the kV and mAs value can't be initialized yet, therefore indicate the kV=0 and mAs=0.2 display.
1	STANDBY Errors that can be detected in the waiting phase of an event. (i.e.: preparation and/or X-ray).
2	PRERX Errors that can be detected during the X-ray preparation phase.
3	RX Errors that can be detected during the X-ray phase.

Reference table of the alarm events generators

EE

Code number	Events generator
0	EV_VARIE These are referred to the events that are not strictly linked to a specific part of the unit hardware or to the MPB board. (Management Process Board), for example: test on X-ray button.
1	EV_STARTER These are refereed to the events that are strictly linked to the hardware management of the starter functioning and check.
2	EV_FILAMENT These are referred to the events that are strictly linked to the hardware management of the X-ray tube filament.
3	EV_CHARGER These are referred to the events that are strictly linked to the hardware management of the capacitors battery loading of the unit.
4	EV_CAPACT These are referred to the events that are strictly linked to the hardware that controls and monitories the capacitors battery placed in the unit.
5	EV_CHOPPER These are referred to the events that are strictly linked to the hardware management of the chopper control and functioning.
6	EV_INVERTER These are referred to the events that are strictly linked to the INVERTER module.
7	EV_SUPPLY These are referred to the events that are strictly linked to the supply module present in the unit.
8	EV_TUBE These are referred to the events that are strictly linked to the unit X-ray tube.
9	EV_DOSIMETER These are referred to the events that are strictly linked to the module for the reading of the dose present on the unit (dosimeter).
10	EV_MEMORY These are referred to those events that are strictly linked to the data writing and reading in the unit memory buffer (EEPROM).

Alarms reference table

NN

Code number	Alarm string
2	POWER FAULT Power unit fault (Power Unit).
3	V3 FAULT Power unit supply (Power Unit).
6	TUBE SEASONING The X-ray tube requires the Seasoning.
8	FILAMENT Problems on/in the check of the X-ray tube filament.
9	HOT TUBE X-ray tube too hot.
10	V2 FAULT Unit control supply.
11	STARTER INTERLOCK Blocked Starter or insufficient rotation.
12	CHOPPER FAULT Problems of energy transfer to the INVERTER.
16	LACK OF X-RAY X-ray lack.
17	MAX TIME Max. exposure time (2s) expired.
18	DATA ERR. Data reading error.
19	MAN STOP RX The X-ray button has been released before the end of the exposure set.
20	INVERTER KV ERR. kV on the INVERTER module out of range.
21	INVERTER OVERLOAD Overload INVERTER.
22	INVERTER FAULT IGBT error on the INVERTER module.
23	ERR.TUBE CALIB. The tube calibration has not been performed or an error in the calibration data check has been detected. It is necessary to repeat the calibration.
25	HAND SWITCH ERR The X-ray button is broken or pressed in the Start up phase.
26	INACTIV Dosimeter is absent or not connected.
27	ACTIV Active dosimeter and ready to work.
28	NOT OK Connected dosimeter but unable to work properly.

Warnings and error messages

- When the 1st line of the display shows an error message press RESET button to re-activate the unit.
- If the unit is blocked, the 1st line shows an error and the 2nd line shows “Call Service”, this means that a fatal error has occurred.

F = fatal error
W = warning
S = unit status
R = this message is stored in memory (menu ALARM)

Display	Meaning	What to do		
MANUAL			S	-
READY	The unit is ready for exposure		S	-
BUSY	Set waiting time is running to avoid overheating the tube assembly	Wait for READY message	S	-
CLOCK OFF	Clock system fault	Press RESET and continue	W	-
POWER FAULT CALL SERVICE	Charger and chopper circuits fault Energy not available	Switch OFF, wait for some minutes, switch ON, if error re-appears call service	F	R
V3 FAULT CALL SERVICE	V3 supply not present	Switch OFF, wait for some minutes, switch ON, if error re-appears call service	F	R
RESET APR	APR checksum fault	Press RESET and continue	W	-
APR OUT OF RANGE	An APR value is out of range	Adjust parameters	W	-
TUBE SEASONING	After a long period of un-use (3 months or more) it’s necessary to perform the setting-in of the X-ray tube, in order to avoid any damage	Press RESET and continue, call service for tube setting-in	W	R
FILAMENT CALL SERVICE	No filament current	Switch OFF, wait for some minutes, switch ON, if error re-appears call service	F	R
HOT TUBE	The monobloc temperature reached the max value allowed	Wait for the monobloc cooling before proceeding	W	R
V2 FAULT CALL SERVICE	Lack of power supply V2 to circuits of mA and kV set	Switch OFF, wait for some minutes, switch ON, if error re-appears call service	F	R
STARTER INTERLOCK	Error in anode start time	Push RESET button, repeat exposure, if error re-appears call service	F	R
CHOPPER FAULT	Error in chopper device	Push RESET button, repeat exposure, if error re-appears call service	F	R
TIME OUT	The first step of the push button controls radiography preparation. If you stand in this state for more then 15s this warning appear	Release push button and repeat radiography	W	-
LACK OF X-RAY	The kV have not reached the 85% of the set value in the first 10ms of exposures, or there is no high voltage	Push RESET button, repeat exposure, if error re-appears call service	F	R
MAX TIME	The max exposure time (2s) has been reached	Push RESET button, repeat exposure, if error re-appears call service	F	R
DATA ERR. CALL SERVICE	Checksum data error, memory error	Switch OFF. Call service	F	R
MAN STOP RX	The X-ray push button has been released before the end of exposure	Push RESET button, then repeat radiography and release the push button when three beeps are heard	W	-
INVERTER KV ERROR	During X-ray emission kV decrease under 85% or increase over 110% of set value OR High voltage circuit is unbalanced during an exposure	Push RESET button, repeat exposure, if error re-appears call service	F	R

Display		Meaning	What to do		
INVERTER OVERLOAD		Power out of range	Push RESET button, repeat exposure, if error re-appears call service	F	R
INVERTER FAULT		IGBT drivers error	Push RESET button, repeat exposure, if error re-appears call service	F	R
ERR. TUBE CALIB. CALL SERVICE		Tube calibration error	Call service	F	R
HAND SWITCH ERR		Faulty device	Try again, if error persists call service	F	R
Dosimeter	INACTIVE	Dosimeter not present		W	R
	ACTIV	Dosimeter OK		S	
	NOT OK	Dosimeter connected but faulty		W	R
	MAXDOSE	Dose values integration has reached the maximum value	Press F1 button to reset the value	S	-

This is a list of the messages and warnings that appear on the display in any configurable language.

English (GB)	German (D)	French (F)	Spanish (E)
ENG	GER	FRE	SPA
CLOCK OFF	TAKTGEBER DEFEKT	CHRONO DEF.	FALLO RELOJ
POWER FAULT	STROMVERSORG.DEF	BAT.DEFECT.	FALLO ACUMUL.
V3 FAULT	V3 DEFEKT	V3 DEFECT.	FALLO V3
RESET APR	APR-DATEN DEFEKT	INI.APR	INI.APR
APR OUT OF RANGE	APR-WERT FALSCH	APR DEFECT.	FALLO APR
TUBE SEASONING	RÖHRE ENFAHREN	FORM. DU TUBE	AJUSTE DEL TUBO
CALL SERVICE	SERVICE REFEN	APPELER SERVICE	LLAMAR SERVICIO
FILAMENT	HEIZKREIS-FEHLER	FILAMENT	FILAMENTO
HOT TUBE	RÖHRE HEISS	TUBE CHAUD	TEMPER.
V2 FAULT	V2 DEFEKT	V2 DEFECT.	FALLO V2
STARTER INTERLOOK	ANLAUF-FEHLER	BLOCAGE DEMARREUR	BLOQUEO CEBADOR
CHOPPER FAULT	CHOPPER-FEHLER	HACHEUR DEFECT.	FALLO PULSADOR
TIME OUT	PREP ZU LANG	TEMPS EXPIRE	FUERA TIEMPO
READY	BEREIT	PRET	LISTO
BUSY	WARTEN	ATTENDRE	ESPERA
LACK OF X-RAY	KEINE STRAHLUNG	FAUTE RAYON	SIN RADIACION
MAX TIME	MAX EXP ERREICHT	TEMPS MAX	TIEMPO MAX
DATA ERR.	DATEN-FEHLER	FAULE DE VALEUR	FALLO DATO
MAN STOP RX	EXP UNDERBROCHEN	STOP MANUAL	INTERRUP. MANUAL
INVERTER KV ERR.	WANDLER KV FEHLER	TRANSF. KV DEFECT	FALLO KV TRANSF
INVERTER OVERLOAD	WANDLER ÜBERLAST	TRANSF.SURCHARGE	SOBRECARGA TRANSF
INVERTER FAULT	WANDLER FEHLER	TRANSF.DEFECTUEUSE	FALLO TRANSF
ERR.TUBE CALIBR.	RÖHRE KALIBRIEREN	CALIB.DEFECT.	FALLO CALIB.
MANUAL	MANUELL	MANUAL	MANUAL
HAND SWITCH ERR	HANDSCHALT.DEF	BOUTON DEFECT.	FALLO MANDO
INACTIV	INAKTIV	INACTIF	INACTIV
ACTIV	AKTIV	ACTIF	ACTIV
NOT OK	NOT OK	NON OK	NO OK
MAXDOSE	MAXDOSE	MAXDOSE	MAXDOSE

menu INIT.APR: APR initialization

To initialize the APR memory with the default values set during the unit manufacturing, it is sufficient to press once the F4 button by the SETUP menu, and then, wait for some seconds. A double beep will indicate the initialization performance.

During this operation no confirmation will be asked.

APR programs and default parameters

Group		Program	kV	mAs
SKULL ABDOMEN		Thorax ap	90	6.3
		Skull	75	25
		Cervical Spine	70	8
	v	Thoracical Spine ap	70	32
	^	Lumbar Spine ap	70	40
		Abdomen ap	80	16
		Pelvis ap	70	25
		Hip ap	70	20
UPPER EXTREMITIES		Shoulder ap	66	5
		Clavicle	66	32
		Humerus/elbow	60	12.5
	v	Elbow	60	10
	^	Forearm	55	12.5
		Wrist	55	8
		Hand ap	50	8
		Finger	45	2
LOWER EXTREMITIES		Hip/Femur	70	10
		Femur	60	5
		Knee	55	5
	v	Lower Leg	55	5
	^	Ankle	55	4
		Calcaneus	55	3.2
		Foot	55	3.2
		Toes	44	2
CHILDREN		Thorax 0.5 Kg	60	0.2
		Thorax 1.0 Kg	60	0.32
		Thorax 2.0 Kg	62	0.4
	v	Thorax 4.0 Kg	70	0.4
	^	Thorax 6.0 Kg	74	0.4
		Thorax 8.0 Kg	76	0.4
		Thorax 10 Kg	76	0.8
		Thorax 15 Kg	76	1.0

This is a list of the APR programs that appear on the display in any configurable language.

Group APR programs			
English (GB)	German (D)	French (F)	Spanish (E)
SKULL ABDOMEN	SCHAEDEL/ABDOMEN	CRANE/ABDOMEN	CRANEO/ABDOMEN
Thorax ap	Thorax ap	Thorax ap	Thorax ap
Skull	Schaedel	Crane	Craneo
Cervical Spine	HWS	Col.Cervical	Vertebras Cerv.
Thoracical Spine ap	Brust WS ap	Col.Dorsal	Vertebras Dors.
Lumbar Spine ap	LWS ap	Col.Lumbaire	Vertebras Lumb.
Abdomen ap	Abdomen ap	Abdomen ap	Abdomen ap
Pelvis ap	Becken ap	Bassin ap	Pelvis ap
Hip ap	Huefte ap	Hanche ap	Coxal ap
UPPER EXTREMITIES	OBERE EXTREMIT.	EXTREMITES SUP.	EXTREMID. SUPERIOR
Shoulder ap	Schulter ap	Epaule ap	A.Escap Hum.
Clavicle	Schluesselbein	Clavicule	Clavicle
Humerus/elbow	OA/Ellenbogen	Humerus/Coude	Humero/Codo
Elbow	Ellenbogen	Coude	Codo
Forearm	Unterarn	Bras inf.	Antebrazo
Wrist	Handgelenk	Poignet	Munica
Hand ap	Hand ap	Main ap	Mano ap
Finger	Finger	Doigts	Dedos Mano
LOWER EXTREMITIES	UNTERE EXTREMIT.	EXTREMITES INF.	EXTREMID. SUPERIOR
Hip/Femur	Huefte/OS	Hanche/Femur	Coxal/Femur
Femur	OS	Femur	Femur
Knee	Knie	Genou	Rodilla
Lower Leg	US	Jamb inf.	Pierna inf.
Ankle	Fussgelenk	Art.Tibio Tors.	Tobillo
Calcaneus	Fersenbein	Calcaneum	Calcaneus
Foot	Fuss	Pied	Pie
Toes	Zehen	Orteils	Dedos Pie
CHILDREN	KINDER	ENFANTS	CHILDREN
Thorax 0.5 Kg	Thorax 0.5 Kg	Thorax 0.5 Kg	Thorax 0.5 Kg
Thorax 1.0 Kg	Thorax 1.0 Kg	Thorax 1.0 Kg	Thorax 1.0 Kg
Thorax 2.0 Kg	Thorax 2.0 Kg	Thorax 2.0 Kg	Thorax 2.0 Kg
Thorax 4.0 Kg	Thorax 4.0 Kg	Thorax 4.0 Kg	Thorax 4.0 Kg
Thorax 6.0 Kg	Thorax 6.0 Kg	Thorax 6.0 Kg	Thorax 6.0 Kg
Thorax 8.0 Kg	Thorax 8.0 Kg	Thorax 8.0 Kg	Thorax 8.0 Kg
Thorax 10 Kg	Thorax 10 Kg	Thorax 10 Kg	Thorax 10 Kg
Thorax 15 Kg	Thorax 15 Kg	Thorax 15 Kg	Thorax 15 Kg

ACCESORIES AND OPTIONALS

DAPmeter

Purpose of the DAPmeter device is the Dose Area Product Measurement [cGycm^2] in output to the patient. The Practix 100 plus foresees, as option, the connection to an ionization rectangular chamber, whose frequency output signal is proportional to the measurement.
The chamber type is: PTW FREIBURG DIAMENTOR PX – T11020-00011.

How to install the device

The DAPmeter installation consists of:

- Location of the measuring chamber under the collimator;
- Electric connection of the chamber through the wiring already provided on the unit;
- Enablation of the software program for the reading and display of the measures.

The installation has to be performed ONLY by AUTHORIZED Service staff.

Installation procedure

1. Insert the device in the dedicated slides placed under the collimator.

2. Check on the cable of the chamber connector that voltage value and supply polarity are proper:
   pin 1 → +15V
   pin 2 → 0V

3. Insert the connector in the DAPmeter and screw the ground point to the GND clamp.

4. Turn the unit ON in SERVICE MODE and by SETUP → CONFIG menu, select the DOSIMETER=ON parameter.

5. Turn the unit OFF.

What's different with the DAPmeter installation?

Start Up phase

By the installation of the DAPmeter device (parameter DOSIMETER=ON), during ignition, a diagnostic test is performed and the display is as follows:

D	O	S	I	M	E	T	E	R					x	x	x	x	x		
		P	R	A	C	T	I	X		1	0	0		P	L	U	S		
					V	E	R		1	.	0	0	.	0	A				
>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>			

xxxxx can have the following values and the following meanings:

- ACTIV: the chamber reading is activated and works properly;
- INACTIV: the chamber reading is activated but the chamber is absent or not connected;
- NOT OK: the chamber reading is activated but does not work properly.

Normal use

If DAPmeter has been installed and works properly, the first line of the display alternatively shows the *measures summation* and the unit measures. [cGycm^2]:

					R	E	A	D	Y			0	0	0	0	0	0	.	0

					R	E	A	D	Y				c	G	y	c	m	2	

The *measurements summative* is the addition of all the Dose Area Products read by the ionization chamber. By the pressure of the F1 button, the value of measures summation is zeroed.

$$\sum_{i=1}^{n} \text{dose}_i \cdot \text{area}_i$$

"n" is the number of exposures performed after the last pressure of the F1 button.

To know the Dose Area Product to be subjected to the patient, it will be necessary to press F1 button before beginning the exam.
The measuring field of the *summation* is comprised between 000000.0cGycm^2 and 999999.9cGycm^2. When the measurement summation exceeds the 999999.9cGycm^2 value, the display will show "MAXDOSE" message. The presence of this message does not exclude the possibility to perform new exposures.

Functioning Test

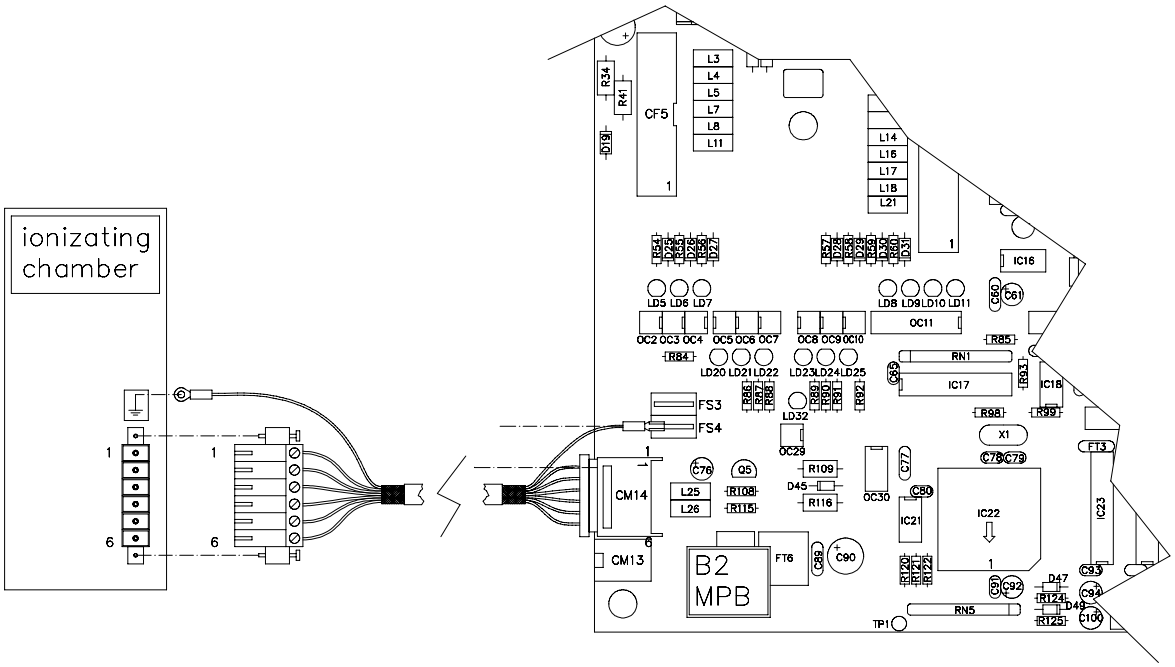
Warning. Operation with X-ray presence; follow every proper protection and precaution.

To verify the right functioning of the device:

- Completely open the collimator shutters and set 63kV - 2,5mAs.
- Perform a series of 3 or more radiography and check that for every radiography the summation is integrated of 10,5 cGycm^2 (±0,5). The indicative time of each exposure is of 20ms.

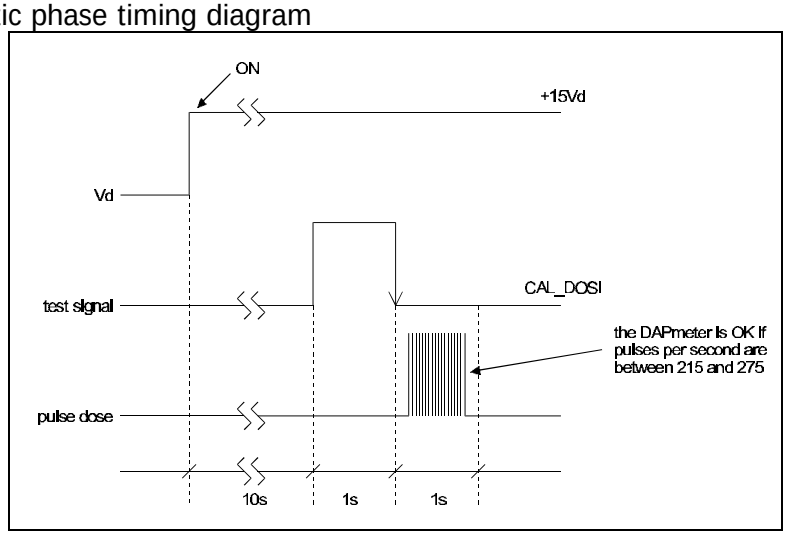
Connections and segnals

Here below follows a description of the connection between ionization chamber of DAPmeter and B2-MPB board.



pin	color	function	
1	pink	+15Vd	supply
2	gray	0Vd	
3	yellow	+	test signal
4	green	-	
5	brown	+	pulse signal
6	white	-	
shield		shield	

DAPmeter diagnostic phase timing diagram



FAQ

This part includes some of the most frequent questions (frequently asked questions) and the corresponding technicians replies.

Q: ***Does the SERVICE MODE present some risky status?***
R: Yes, for example, some calibrations and operations require repeated X-ray emissions. This requires the use of proper protections and precautions.

Q: ***Why isn't possible to enter the SM anytime, but only during the Start up phase? Furthermore, why is it necessary to insert an activating code?***
R: The SM permits to modify important parameters and to perform operations that, if performed without proper precautions, can cause severe damages to the unit and operator. In order to limit any risk, only qualified and trained personnel can understand every phase of the SM; the normal user must not have any possibility to enter this procedure.

Q: ***Why is it possible to delete the error list?***
R: Anytime that the unit maintenance is performed, it is useful to know the list of the errors that occurred after the last intervention on the unit. This way, it is possible to deduce more useful information, even relating to the most recent life-time of the unit. This is the purpose of the possibility to delete the list.

Q: ***What are the possible advantages and disadvantages of having the brake of the rotating anode at the end of exposure?***
R: The advantages are represented by a more silent unit and by the lower wear and tear of the anode bearings; while the main disadvantage will be higher thermal leakages. In fact, every time that the anode is braked, a heating production inside the monobloc will correspond.

DOCUMENT STATUS

Rev.	*Date*	*Page*	*Modification description*
0			Document approval
1			
2			
3			
4			
5			

PRACTIX 100 PLUS

PARTS LIST

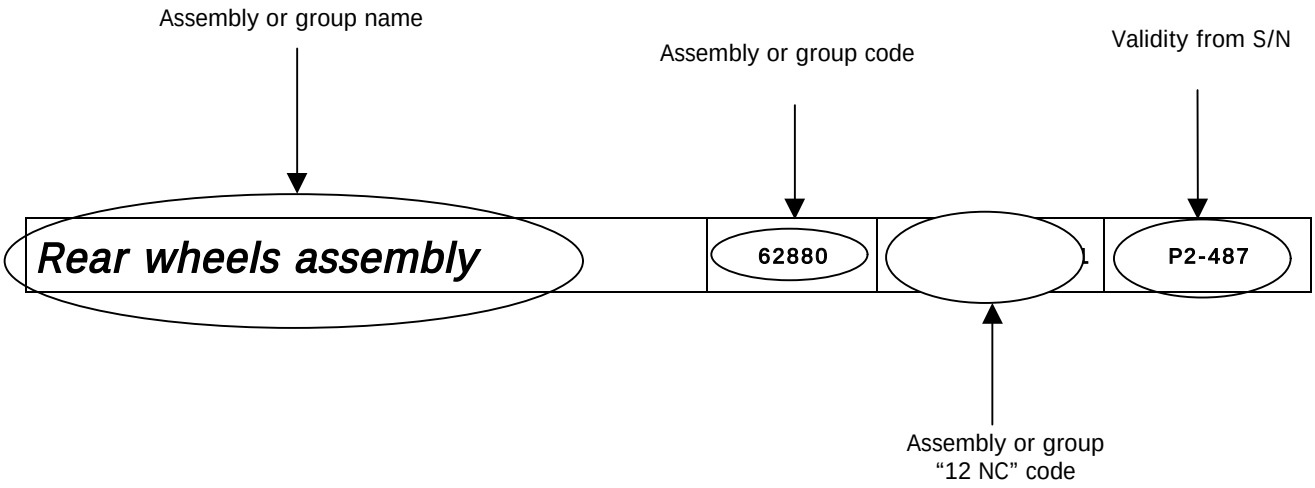
[File: W3018_Rev1.doc]

NOTES 2

LIST 3

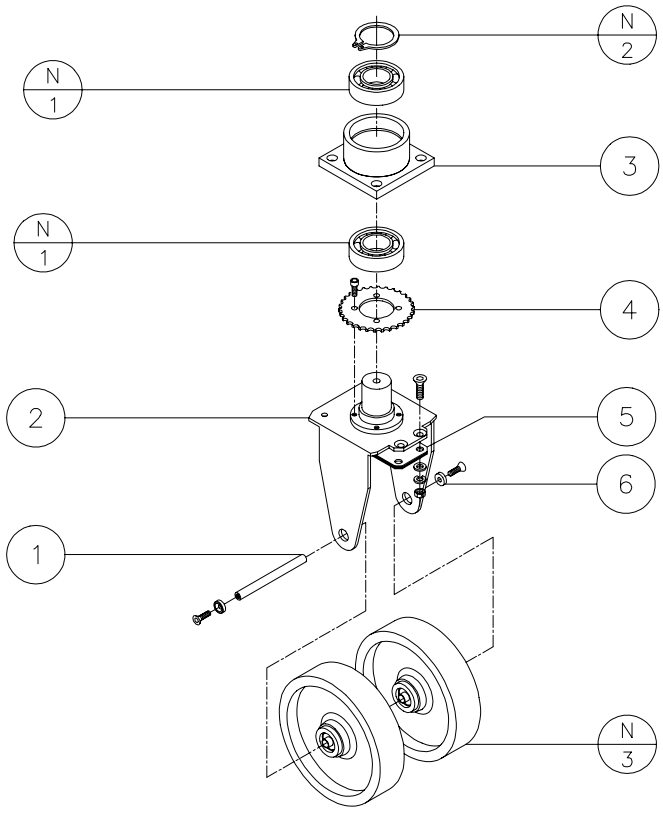
Rear wheels assembly 3
Rear wheels assembly 4
Rear wheels assembly 5
Tilting pedal assembly 6
Basement group with wheels and chain 7
Unit stand group with cover and column 8
Unit stand group with arm and spring 9
Unit stand group with monobloc support 11
Capacitors assembly 13
Power unit assembly 14
Automatic assembly and mains filter 16
Control unit group 17
Unit stand group with electronics 19
Unit stand group with cover 21

NOTES


Assembly or group name
Assembly or group code
Validity from S/N
Rear wheels assembly
62880
P2-487
Assembly or group
“12 NC” code

LIST

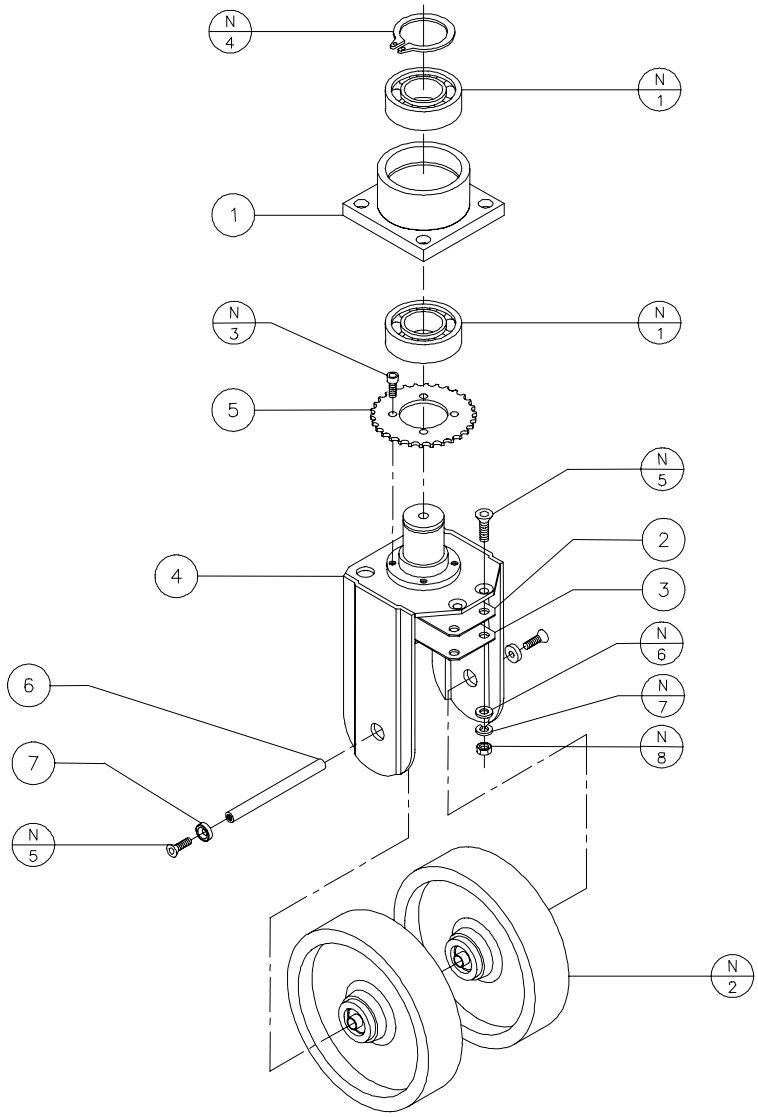
Rear wheels assembly	62880	4512-132-23011	P2-487



picture 1

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
1	1	wheels pivot	1	54189	4512-132-23201	P2-487
1	2	welded wheel support	1	54255	4512-132-23211	P2-487
1	3	rear support block	1	53726	4512-132-23221	P2-487
1	4	rear wheel pinion	1	53527	4512-132-23231	P2-487
1	5	wheels brake strap	3	53526	4512-132-23241	P2-487
1	6	washer	2	54239	4512-132-23251	P2-487
1	N/1	sphere bearing Mod. 6005-2Z	2	71520	4512-132-23261	P2-487
1	N/2	shaft blocking ring A25 - DIN471	1	71408	4512-132-23271	P2-487
1	N/3	rubber wheel 150x30	2	71895	4512-132-23281	P2-487

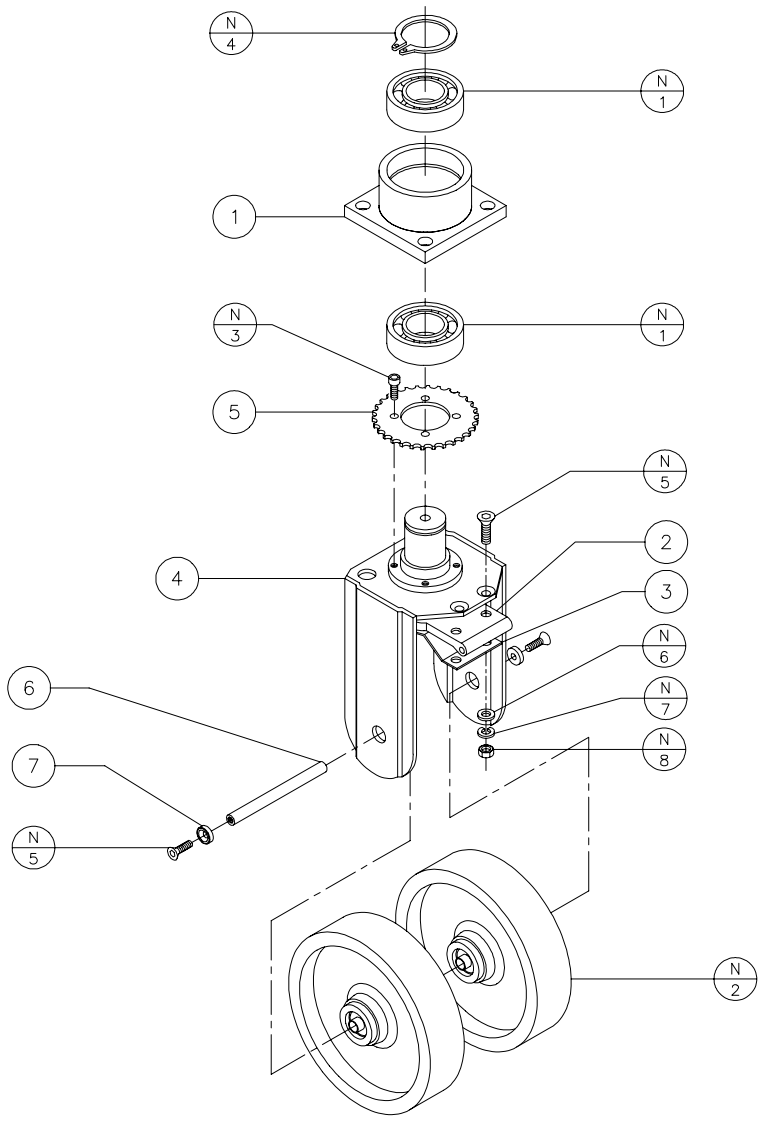
Rear wheels assembly	62881	4512-132-23012	P2-489



picture 1

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
1	1	rear support block	1	53726	4512-132-23221	P2-487
1	2	wheels brake strap	1	53526	4512-132-23241	P2-487
1	3	rear wheel brake	1	54285	4512-132-24881	P2-489
1	4	welded wheel support	1	54305	4512-132-24871	P2-489
1	5	rear wheel pinion	1	53527	4512-132-23231	P2-487
1	6	wheels pivot	1	54189	4512-132-23201	P2-487
1	7	washer	2	54239	4512-132-23251	P2-487
1	N/1	sphere bearing Mod. 6005-2Z	2	71520	4512-132-23261	P2-487
1	N/2	rubber wheel 150x30	2	71895	4512-132-23281	P2-487
1	N/3	shaft blocking ring A25 - DIN471	1	71408	4512-132-23271	P2-487

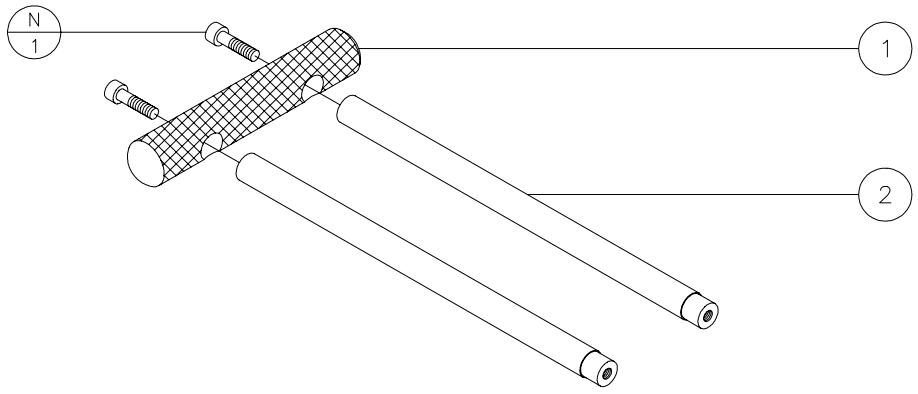
Rear wheels assembly	62883	4512-132-23013	P2-494



picture 1

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
1	1	rear support block	1	53726	4512-132-23221	P2-487
1	2	welded brake plate	1	54310	4512-132-24891	P2-494
1	3	spring for brake	1	54299	4512-132-24901	P2-494
1	4	welded wheel support	1	54305	4512-132-24871	P2-489
1	5	rear wheel pinion	1	53527	4512-132-23231	P2-487
1	6	wheels pivot	1	54189	4512-132-23201	P2-487
1	7	washer	2	54239	4512-132-23251	P2-487
1	N/1	sphere bearing Mod. 6005-2Z	2	71520	4512-132-23261	P2-487
1	N/2	rubber wheel 150x30	2	71895	4512-132-23281	P2-487
1	N/3	shaft blocking ring A25 - DIN471	1	71408	4512-132-23271	P2-487

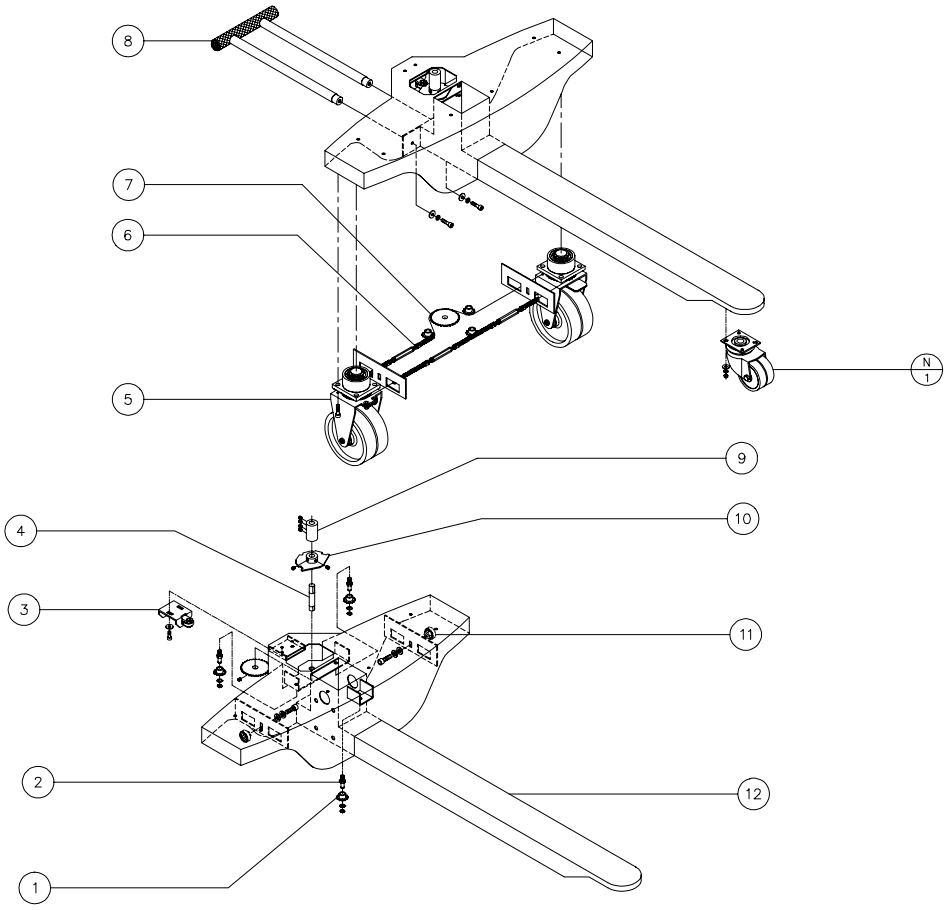
Tilting pedal assembly	62882	4512-132-23021	P2-487



picture 2

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
2	1	tilting pedal	1	54113	4512-132-23301	P2-487
2	2	pedal rod	2	54164	4512-132-23311	P2-487
2	N/1	screw TCEI M6x16 8.8ZNB - DIN 912	2	71063	4512-132-23321	P2-487

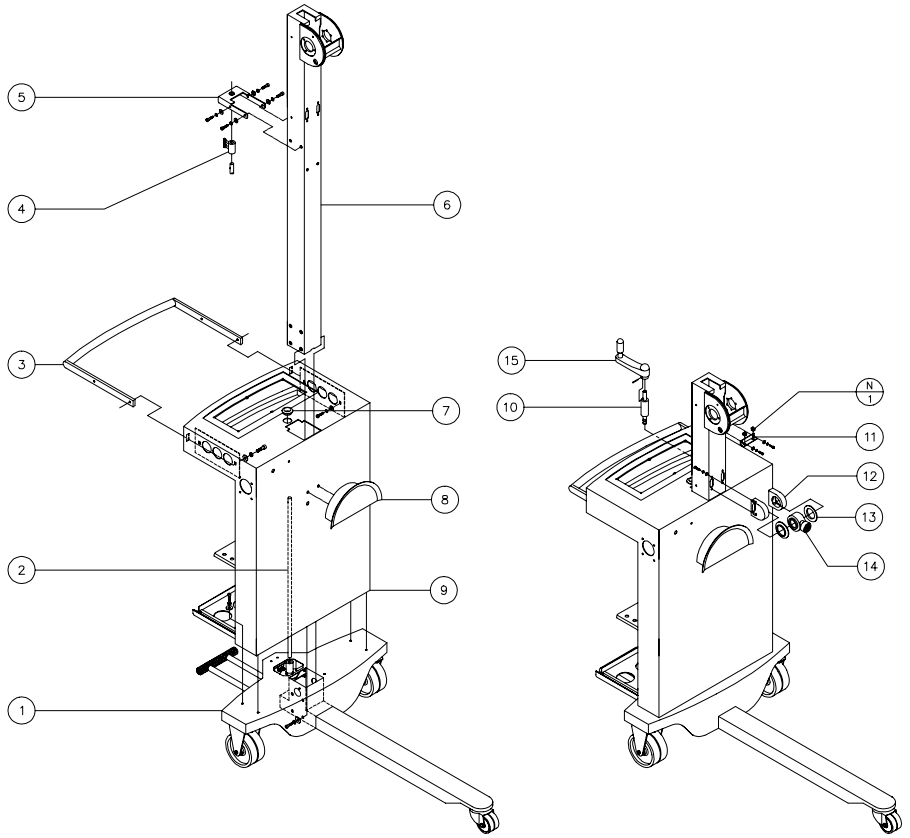
Basement group with wheels and chain	62885	4512-132-23031	P2-487



picture 3

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
3	1	pinion Z9-P8	3	53586	4512-132-23331	P2-487
3	2	gear transmission pivot	3	54190	4512-132-23341	P2-487
3	3	pivot assembly for wheels positioning	1	63004	4512-132-23351	P2-487
3	4	short rod	1	54163	4512-132-23361	P2-487
3	5	rear wheels assembly	2	62883	4512-132-23013	P2-494
3	6	chain for wheel positioning	1	54232	4512-132-23371	P2-487
3	7	pinion	1	53570	4512-132-23381	P2-487
3	8	tilting pedal assembly	1	62882	4512-132-23021	P2-487
3	9	junction	1	53576	4512-132-23391	P2-487
3	10	welded cam for wheels positioning	1	53569	4512-132-23401	P2-487
3	11	register with bearing	2	54317	4512-132-23411	P2-487
3	12	basement	1	54172	4512-132-23421	P2-487
3	N/1	double rubber wheel 80x20	1	71896	4512-132-23431	P2-487

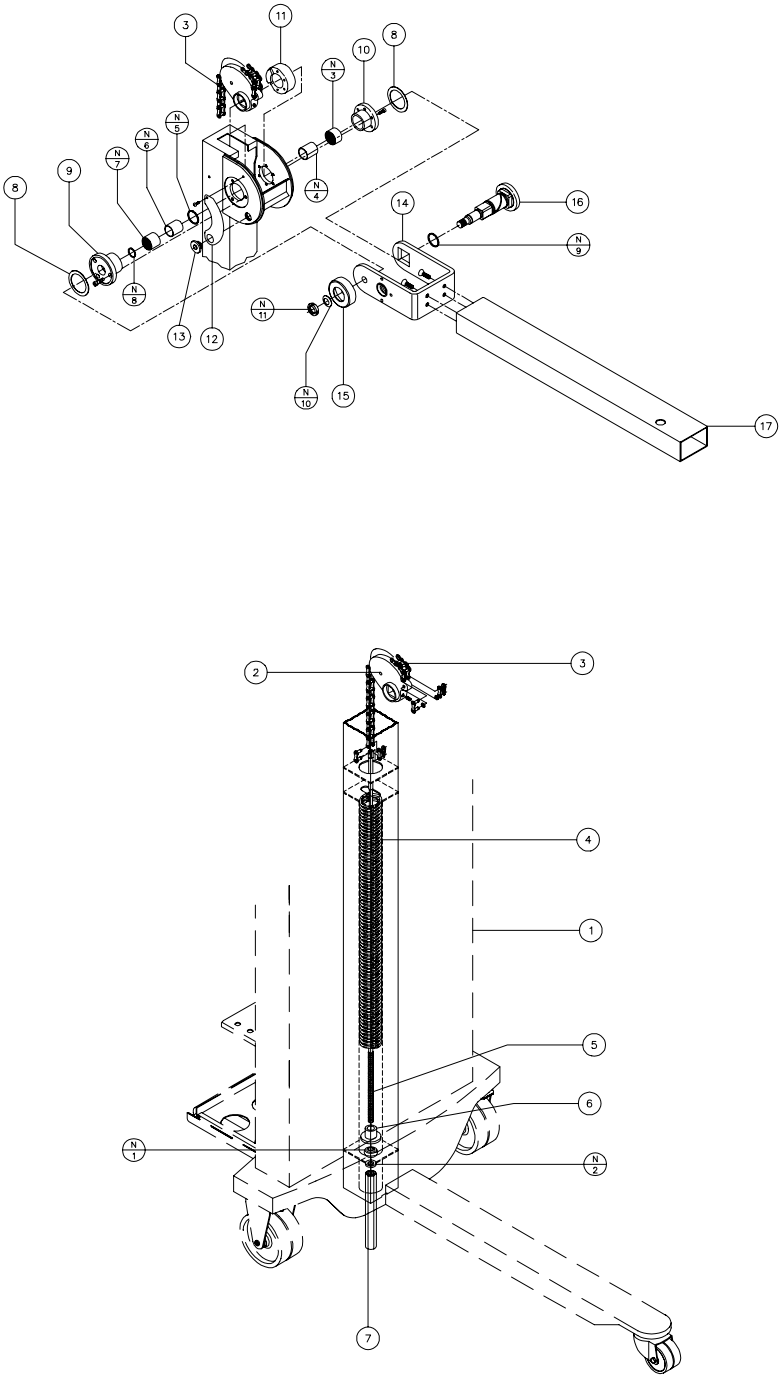
Unit stand group with cover and column	62890	4512-132-23041	P2-487



picture 4

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
4	1	basement group with wheels and chain	1	62885	4512-132-23031	P2-487
4	2	long rod for handle	1	54162	4512-132-23451	P2-487
4	3	handle	1	54208	4512-132-23461	P2-487
4	4	junction	1	53576	4512-132-23391	P2-487
4	5	rod support	1	54159	4512-132-23481	P2-487
4	6	welded column	1	54325	4512-132-23491	P2-487
4	7	handle bush	1	54161	4512-132-23501	P2-487
4	8	cable wiring	1	54154	4512-132-23511	P2-487
4	9	Casing	1	54194	4512-132-23521	P2-487
4	10	pivot for handle clutch	1	54158	4512-132-23531	P2-487
4	11	square	1	54153	4512-132-23541	P2-487
4	12	block	2	54330	4512-132-23551	P2-487
4	13	bush for cable movement	2	54146	4512-132-23561	P2-487
4	14	rotating lock for cable	1	54331	4512-132-23571	P2-487
4	15	handle for rear wheels movement	1	54231	4512-132-23581	P2-487
4	N/1	nut M4 cl.6 plate 2mm	2	71894	4512-132-23591	P2-487

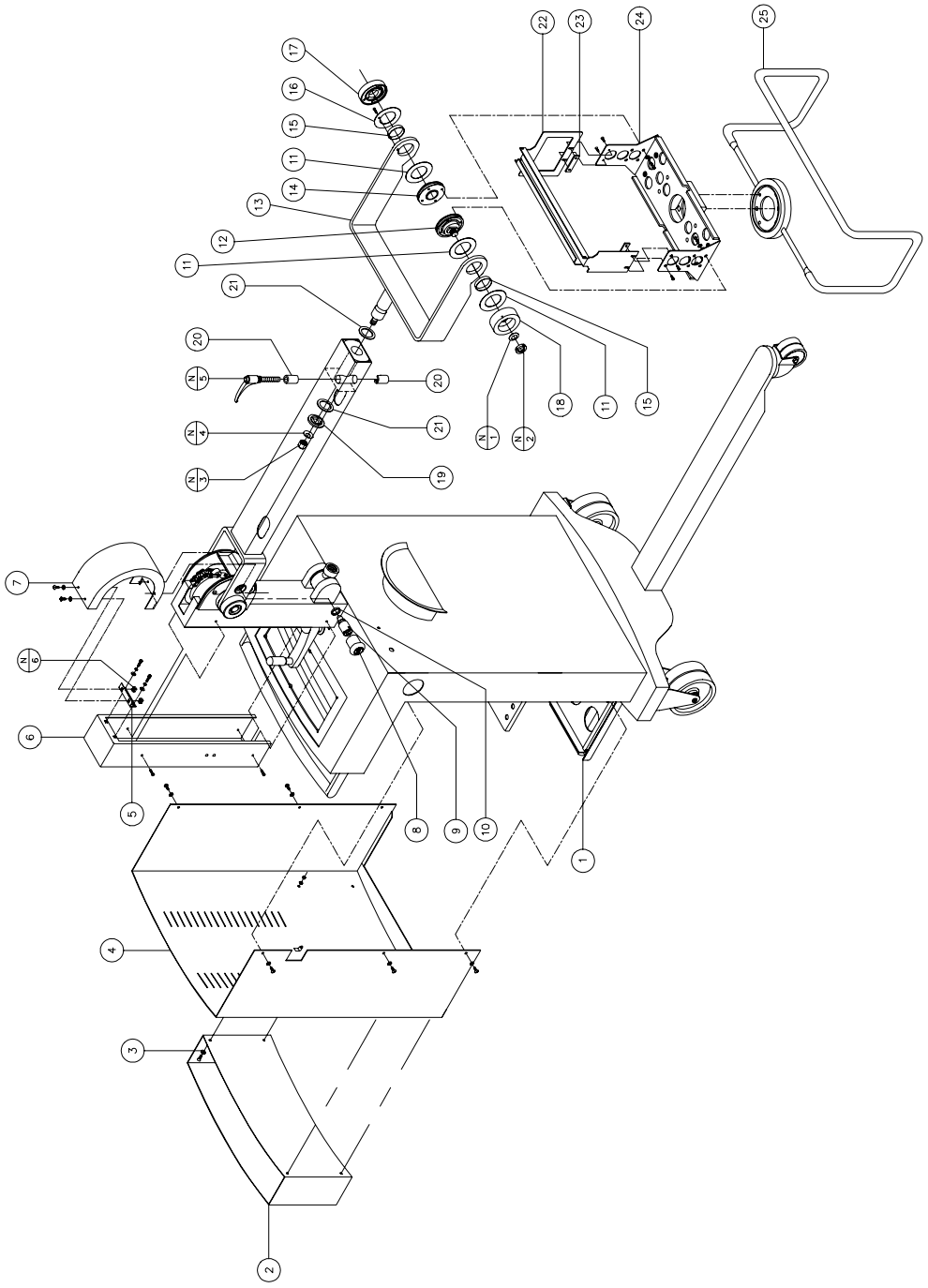
Unit stand group with arm and spring	62895	4512-132-23051	P2-487



picture 5

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
5	1	unit stand group with cover and column	1	62890	4512-132-23041	P2-487
5	2	cams welded group	1	54320	4512-132-23611	P2-487
5	3	cams chain	1	54270	4512-132-23621	P2-487
5	4	arm spring	1	54272	4512-132-23631	P2-487
5	5	spring bush	1	54335	4512-132-23641	P2-487
5	6	spring compass	1	52423	4512-132-23651	P2-487
5	7	tie-rod nut	1	54271	4512-132-23661	P2-487
5	8	clutch disk	2	54251	4512-132-23671	P2-487
5	9	right flange for arm rotation	1	54112	4512-132-23681	P2-487
5	10	left flange for arm rotation	1	54111	4512-132-23691	P2-487
5	11	disk for end run	1	54109	4512-132-23701	P2-487
5	12	protective sheet	1	54144	4512-132-23711	P2-487
5	13	bush for end run pivot	1	52957	4512-132-23721	P2-487
5	14	arm stirrup	1	52420A	4512-132-23731	P2-487
5	15	flange for central shaft	1	52116	4512-132-23741	P2-487
5	16	central pivot	1	54110	4512-132-23751	P2-487
5	17	rotating arm	1	54115	4512-132-23761	P2-487
5	N/1	ball joint	1	71402	4512-132-23771	P2-487
5	N/2	plain washer A13 Fe ZNB - DIN 125	1	71114	4512-132-23801	P2-487
5	N/3	roller bearing INA HK 3520 – DIN 618	1	71892	4512-132-23811	P2-487
5	N/4	internal ring INA IR 30x35x30 – DIN 620	1	71899	4512-132-23821	P2-487
5	N/5	hole ring INA BR32	1	71890	4512-132-23831	P2-487
5	N/6	internal ring INA IR 20x25x30 – DIN620	1	71893	4512-132-23841	P2-487
5	N/7	roller bearing INA HK 2526 – DIN 618	1	71891	4512-132-23851	P2-487
5	N/8	shaft ring INA WR20	1	71888	4512-132-23861	P2-487
5	N/9	shaft ring INA WR30	1	71889	4512-132-23871	P2-487
5	N/10	cup spring CB 31.5X16.3X1.25 – DIN 2093	1	71238	4512-132-23781	P2-487
5	N/11	auto-blocking rod M15x1-KM2 – DIN 981	1	71411	4512-132-23791	P2-487

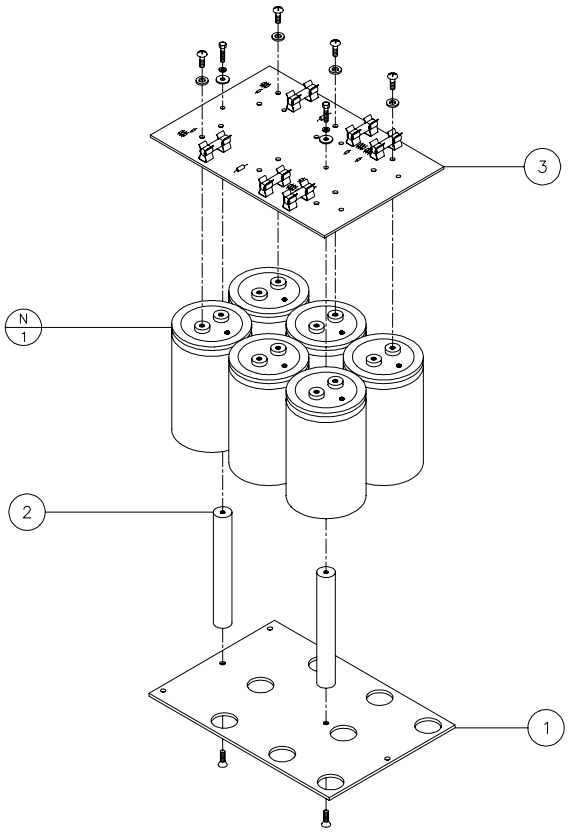
Unit stand group with monobloc support	62900	4512-132-23061	P2-487



picture 6

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
6	1	unit stand group with cover and column	1	62895	4512-132-23051	P2-487
6	2	cassette holder	1	54214	4512-132-23901	P2-487
6	3	washer	4	52858	4512-132-23911	P2-487
6	4	front cover	1	54211	4512-132-23921	P2-487
6	5	square	1	54153	4512-132-23931	P2-487
6	6	upper covering	1	54141	4512-132-23941	P2-487
6	7	column cover	1	54150	4512-132-23951	P2-487
6	8	handle for end run block	1	62408	4512-132-23961	P2-487
6	9	arm end run block	1	62407	4512-132-23971	P2-487
6	10	cylinder spacer	1	52958	4512-132-23981	P2-487
6	11	clutch disk	3	54251	4512-132-23671	P2-487
6	12	right flange for monobloc rotation	1	54118	4512-132-24001	P2-487
6	13	stirrup with pivot	1	54125	4512-132-24011	P2-487
6	14	left flange for monobloc rotation	1	54120	4512-132-24021	P2-487
6	15	ring	2	54253	4512-132-24031	P2-487
6	16	clutch disk	1	54252	4512-132-24041	P2-487
6	17	left external flange for monobloc rotation	1	54121	4512-132-24051	P2-487
6	18	right external flange for monobloc rotation	1	54119	4512-132-24061	P2-487
6	19	washer	1	54122	4512-132-24071	P2-487
6	20	clamp for rotation blocking	1	52141	4512-132-24081	P2-487
6	21	washer for monobloc fork pivot	2	52395	4512-132-24091	P2-487
6	22	monobloc support cover	1	54126	4512-132-24101	P2-487
6	23	plate	2	54127	4512-132-24111	P2-487
6	24	monobloc support	1	54102	4512-132-24121	P2-487
6	25	monobloc movement handle	1	54218	4512-132-24131	P2-487
6	N/1	cup spring CB31,5x16,3x1,5 – DIN 2093	1	71238	4512-132-23781	P2-487
6	N/2	auto-blocking rod M15x1-KN2 – DIN 981	1	71411	4512-132-23791	P2-487
6	N/3	out-blocking nut M12 8ZNB – DIN 982	1	71193	4512-132-24141	P2-487
6	N/4	cup spring CB 25x12,2x0,7 - DIN 2093	1	71502	4512-132-24151	P2-487
6	N/5	handle ERX-78 M10x40	1	71712	4512-132-24161	P2-487
6	N/6	nut M4 cl.6 plate sp. 2mm	2	71894	4512-132-23591	P2-487

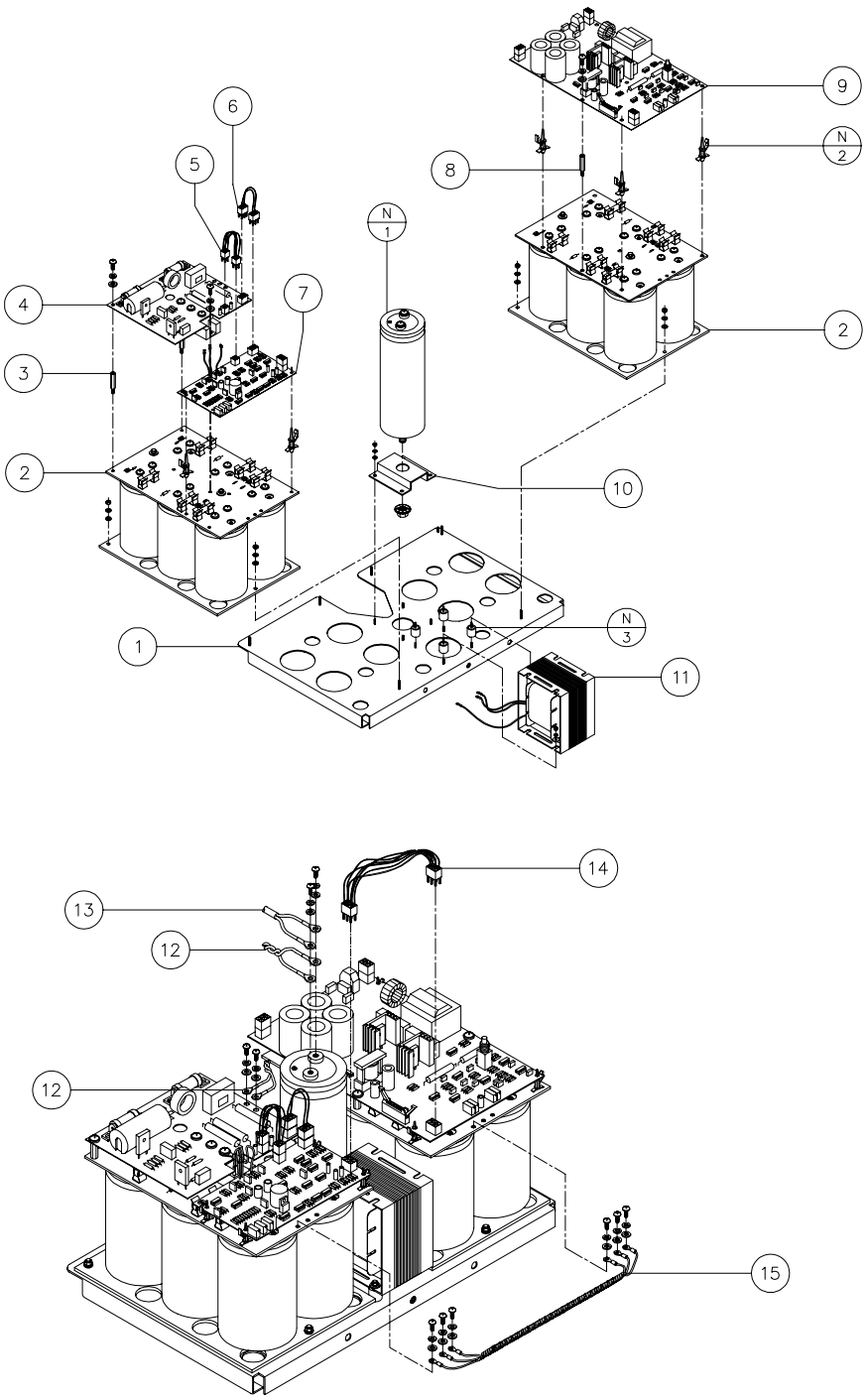
Capacitors assembly	62901	4512-132-23071	P2-487



picture 7

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
7	1	capacitors polycarbonate plate	1	54264	4512-132-24171	P2-487
7	2	capacitors spacer	2	54254	4512-132-24181	P2-487
7	3	capacitors battery board	1	01642	4512-132-24191	P2-487
7	N/1	capacitors	6	11862	4512-132-24201	P2-487

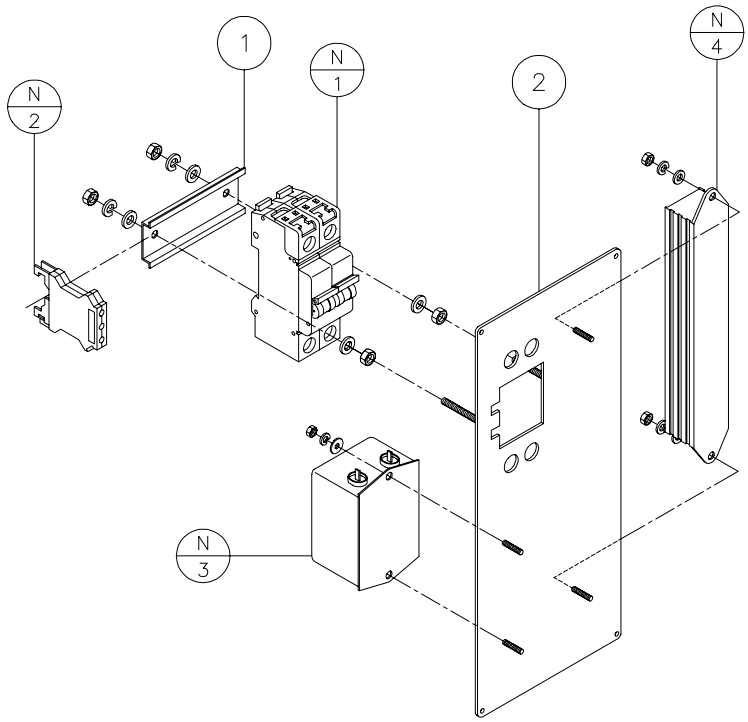
Power unit assembly	62902	4512-132-23081	P2-487



picture 8

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
8	1	capacitors holder plate	1	54221	4512-132-24211	P2-487
8	2	capacitors assembly	2	62901	4512-132-23071	P2-487
8	3	brass spacer	2	54256	4512-132-24221	P2-487
8	4	“B6” chopper board	1	01645	4512-132-24231	P2-487
8	5	fast cable 4 poles 9cm	1	05675	4512-132-24241	P2-487
8	6	fast cable 2+4 poles 9cm	1	05676	4512-132-24251	P2-487
8	7	“B5” control chopper board	1	01644	4512-132-24261	P2-487
8	8	short brass spacer	3	54257	4512-132-24271	P2-487
8	9	“B4” charger board	1	01643	4512-132-24281	P2-487
8	10	capacitors support	1	54247	4512-132-24291	P2-487
8	11	power coil	1	04121	4512-132-24301	P2-487
8	12	B6 board – capacitors connecting cable	1	05681	4512-132-24311	P2-487
8	13	capacitors – inverter connecting cable	1	05682	4512-132-24321	P2-487
8	14	fast cable 6 poles 18cm	1	05674	4512-132-24331	P2-487
8	15	capacitor batteries connecting cable	1	05680	4512-132-24341	P2-487
8	N/1	electrolytic capacitor 10000uF/400Vdc	1	11865	4512-132-24351	P2-487
8	N/2	nylon 25mm spacer	8	11867	4512-132-23181	P2-487
8	N/3	vibration-damping cylinder 15x15xM4	4	71882	4512-132-24371	P2-487

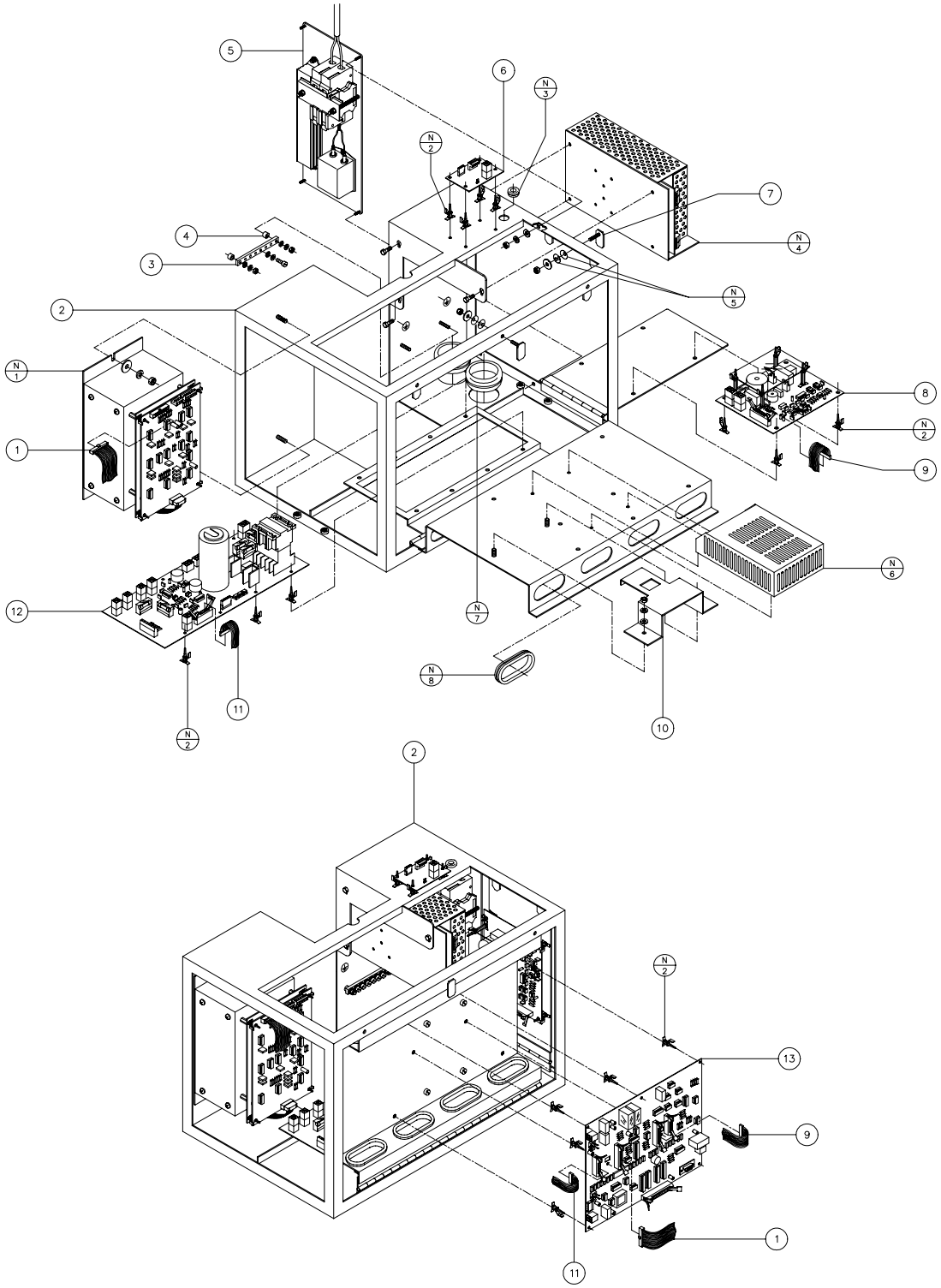
Automatic assembly and mains filter	62904	4512-132-23091	P2-487



picture 9

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
9	1	omega guide for automatic switch support	1	51803	4512-132-24381	P2-487
9	2	automatic switch support	1	54240	4512-132-24391	P2-487
9	N/1	automatic switch	1	11889	4512-132-24401	P2-487
9	N/2	GND clamp “PHOENIX” USLKG6N	1	11157	4512-132-24411	P2-487
9	N/3	mains filter “CORCOM” 3A/220V	1	11920	4512-132-24421	P2-487
9	N/4	armored resistor IP55-150W	1	11887	4512-132-24431	P2-487

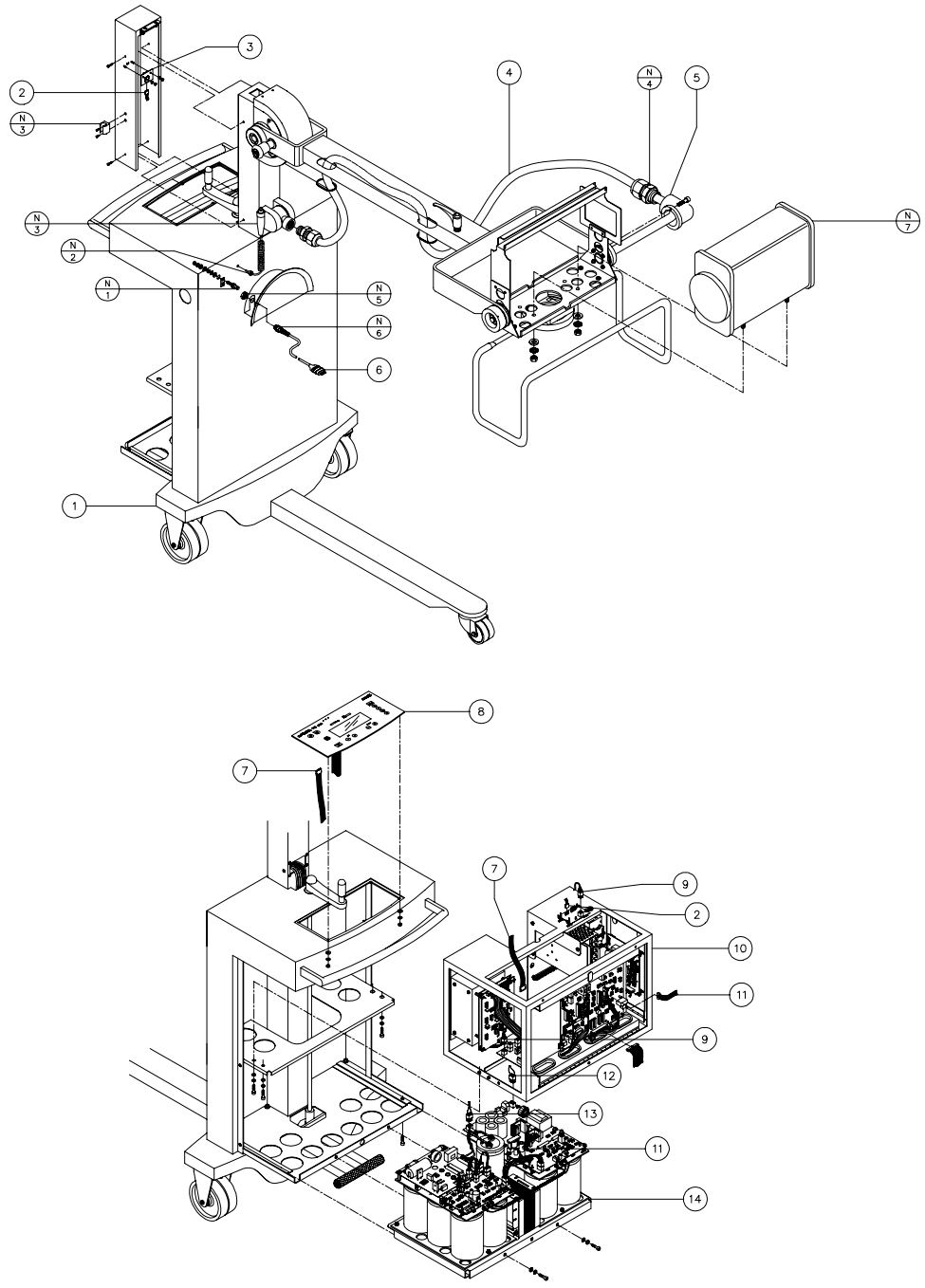
Control unit group	62905	4512-132-23101	P2-487



picture 10

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
10	1	flat cable 26 poles 55cm	1	05670	4512-132-24441	P2-487
10	2	electronics case	1	54222	4512-132-24451	P2-487
10	3	GND copper bar	1	51287	4512-132-24461	P2-487
10	4	GND spacer bar	2	51288	4512-132-24471	P2-487
10	5	automatic assembly and filter	1	62904	4512-132-23091	P2-487
10	6	“B8” board for X-ray button interface	1	01648	4512-132-24481	P2-487
10	7	plate with stud	1	54242	4512-132-24491	P2-487
10	8	“B7” filament 20kHz board	1	01647	4512-132-24501	P2-487
10	9	flat cable 20 poles 50cm	1	05671	4512-132-24511	P2-487
10	10	IR device support	1	54248	4512-132-24521	P2-487
10	11	flat cable 14 poles 30cm	1	05672	4512-132-24531	P2-487
10	12	“B6” starter + on/off board	1	01646	4512-132-24541	P2-487
10	13	“B2” µC board	1	01641	4512-132-24551	P2-487
10	N/1	20kHz inverter (for monobloc)	1	11884	4512-132-24561	P2-487
10	N/2	nylon h9.52 support for board locking	21	11872	4512-132-24361	P2-487
10	N/3	black rubber wire-hitch 110x140x20	1	71272	4512-132-24571	P2-487
10	N/4	switching MPS 150-12 supplier	1	11858	4512-132-24581	P2-487
10	N/5	cup spring CB 12x6.2x0.5 - DIN2093	4	71226	4512-132-24591	P2-487
10	N/6	switching 65MWQ-5151 supplier	1	11859	4512-132-24601	P2-487
10	N/7	black rubber core-hitch	2	71719	4512-132-24611	P2-487
10	N/8	oval black rubber wire-hitch mod. 0V/5	4	71686	4512-132-24621	P2-487

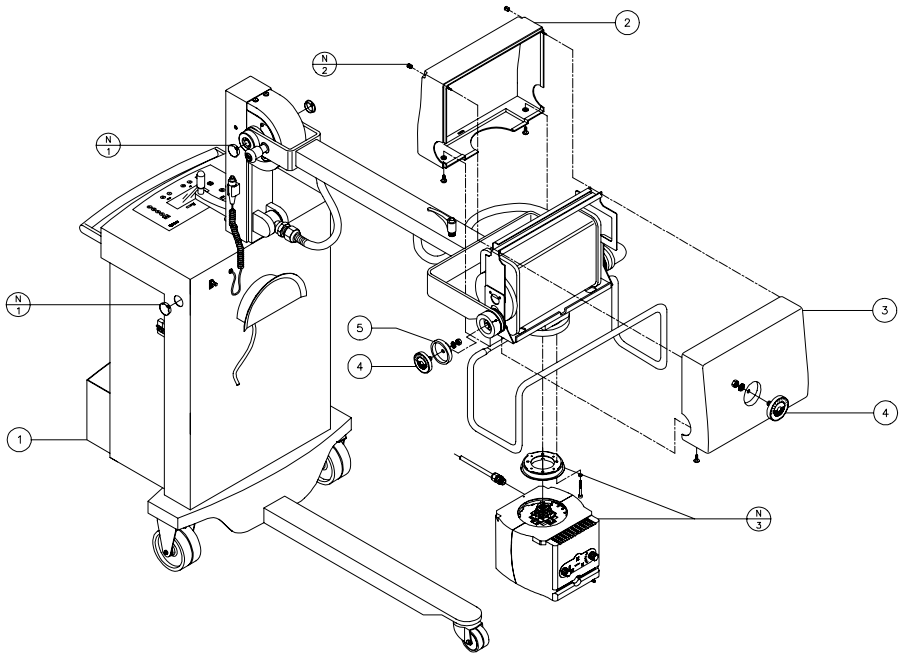
Unit stand group with electronics	**62910**	**4512-132-23111**	**P2-487**

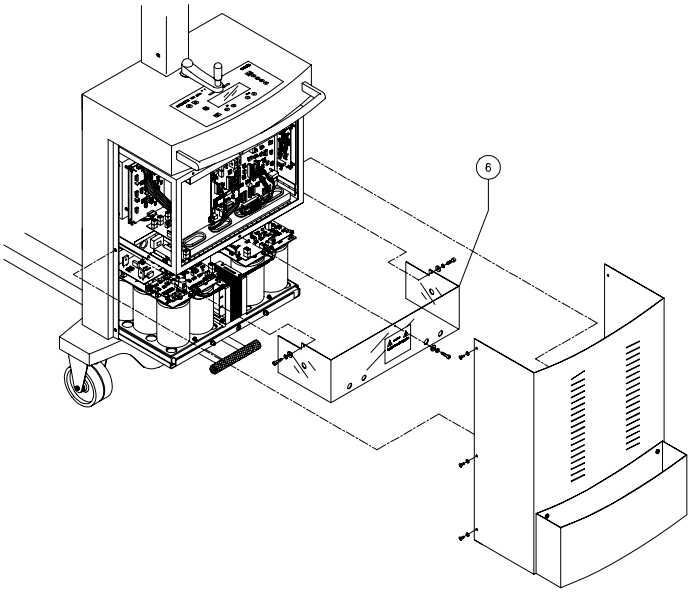


picture 11

PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
11	1	unit stand group with monobloc stand	1	62900	4512-132-23061	P2-487
11	2	flat cable 4 poles 45cm	1	04626	4512-132-24631	P2-487
11	3	“B9” RX control selection board	1	01649	4512-132-24641	P2-487
11	4	monobloc-table connecting cable	1	05684	4512-132-24651	P2-487
11	5	metallic pressing-cable junction	1	52949	4512-132-24661	P2-487
11	6	mains cable	1	05683	4512-132-24671	P2-487
11	7	flat cable 6 poles	1	05100	4512-132-24681	P2-487
11	8	keyboard	1	54259	4512-132-24691	P2-487
11	9	fast cable 4 poles	1	05679	4512-132-24701	P2-487
11	10	table group and control unit group	1	62905	4512-132-23101	P2-487
11	11	flat cable 16 poles	1	05673	4512-132-24711	P2-487
11	12	fast cable 2+4 poles	1	05677	4512-132-24721	P2-487
11	13	fast cable 2+4 poles	1	05678	4512-132-24731	P2-487
11	14	capacitors plate group	2	62902	4512-132-23081	P2-487
11	N/1	equipotential node	1	11454	4512-132-24741	P2-487
11	N/2	“HEYCO” blocking cable	1	11583	4512-132-24751	P2-487
11	N/3	X-ray button	1	11368A	4512-132-24761	P2-487
11	N/4	black plastic pressing cable PG21	1	11575	4512-132-24771	P2-487
11	N/5	“SKINTOP” PG9 nut	1	11249	4512-132-24781	P2-487
11	N/6	“SKINTOP” PG9 blocking cable	1	11246	4512-132-24791	P2-487
11	N/7	mod. MHF 2011 monobloc	1	11883	4512-132-23001	P2-487

Unit stand group with cover	62915	4512-132-23121	P2-487





picture 12

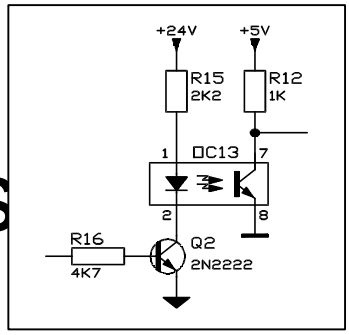
PIC	POS	DESCRIPTION	Q.TY	CODE	12 NC	VALID FROM S/N
12	1	unit stand group with electronics	1	62910	4512-132-23111	P2-487
12	2	monobloc rear cover	1	54100	4512-132-24801	P2-487
12	3	monobloc front cover	1	54101	4512-132-24811	P2-487
12	4	goniometer	2	54275	4512-132-24821	P2-487
12	5	left disk for goniometer case	1	54128	4512-132-24831	P2-487
12	6	shield	1	54249	4512-132-24841	P2-487
12	N/1	black click plug mod. DP1375	3	71404	4512-132-24851	P2-487
12	N/2	black click plug mod. DP375	2	71509	4512-132-24861	P2-487
12	N/3	“RALCO” P232 collimator with rotating adapter	1	11882	4512-104-65262	P2-487

DOCUMENT STATUS

Rev.	*Date*	*Page/s*	*Modification description*
0			Document approval
1	07-04-00	3-4-5	Upgrading brake function
2			
3			
4			
5			

PRACTIX 100 PLUS

ELECTRICAL DRAWINGS



[File: W3020_Rev0.doc]

SUMMARY

SUMMARY 1

DRAWING INDEX 2

Functional drawings 2

Topographic boards 2

COMPONENTS MNEMONIC LABELS TABLE 3

ASSEMBLY VIEW 4

DRAWING INDEX

Functional drawings			
Mod.	Cod. (✠)	Description	Version
	05640	UNIT GENERAL DIAGRAM	
	05641	ON-OFF & COLLIMATOR	
	05642	MPB - SUPPLY - HARDWARE SAFETY - DOSIMETER	
	05643	MPB - IN/OUT & CONVERTERS (ADC-DAC-V/F)	
	05644	CHARGER & CAPACITORS BATTERY	
	05645	CHOPPER CONTROL & CHOPPER	
	05646	IGNITION & STARTER	
	05647	FILAMENT	
	05648	INVERTER	
	05649	GROUNDING	

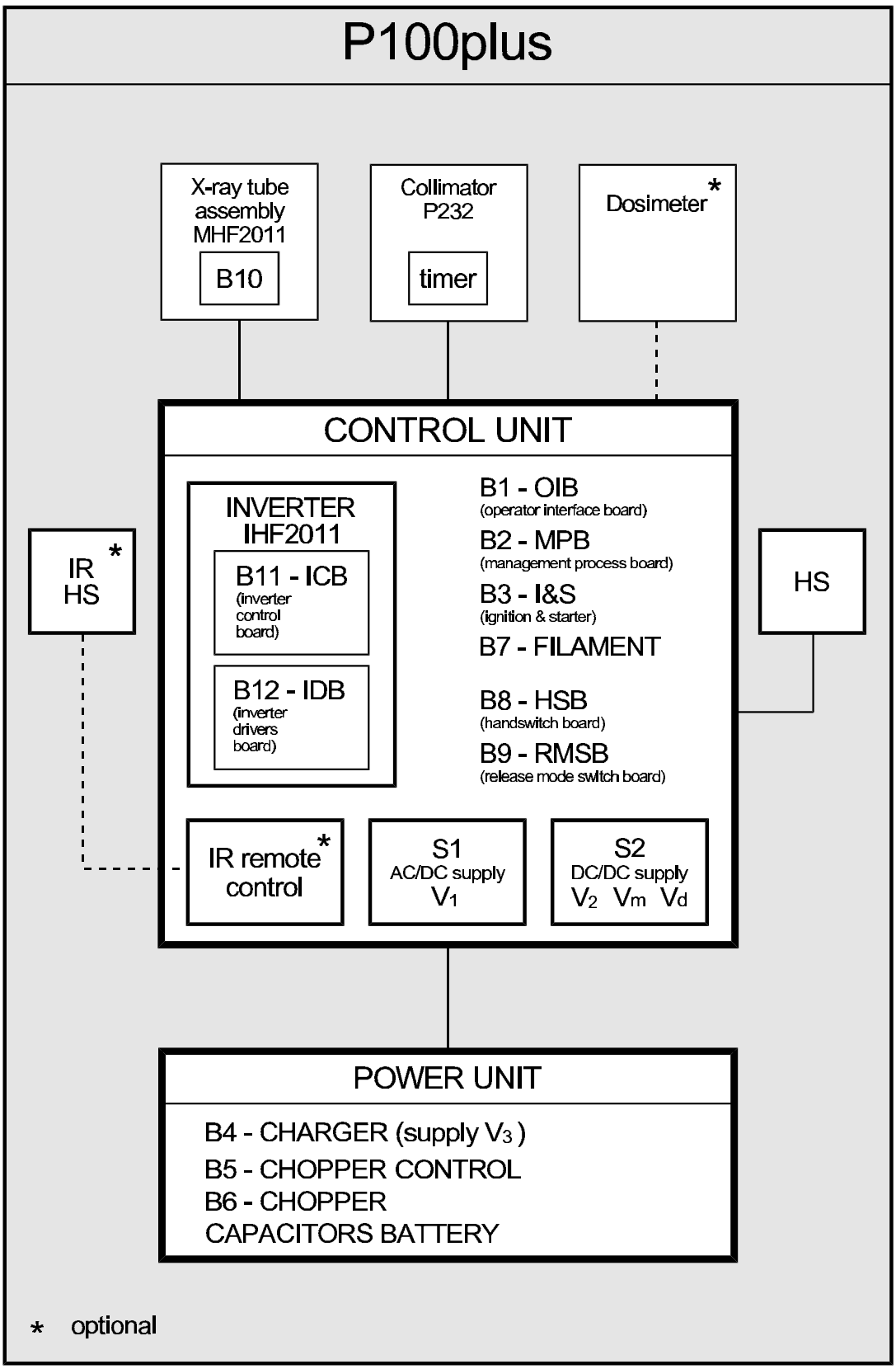
Topographic boards			
Mod.	Cod. (✠)	Label	Description
	01642	-	CAPACITORS BATTERY BOARD
	01640	B1	OPERATOR INTERFACE BOARD (OIB)
	01641	B2	MANAGEMENT PROCESSOR BOARD (MPB)
	01646	B3	IGNITION & STARTER BOARD (I&S)
	01643	B4	CHARGER BOARD
	01644	B5	CHOPPER CONTROL BOARD
	01645	B6	POWER CHOPPER BOARD
	01647	B7	FILAMENT BOARD
	01648	B8	HANDSWITCH BOARD
	01649	B9	RELEASE MODE SWITCH BOARD
	01735	B10	X-RAY TUBE ASSEMBLY BOARD
	01736	B11	INVERTER CONTROL BOARD (ICB)
	01737	B12	INVERTER DRIVERS BOARD (IDB)
	11858	S1	POWER SUPPLY mod. MPS 150-12
	11859	S2	POWER SUPPLY mod. 65 MWR 515

(✠) Code here-in mentioned do not recall the reference peak after “interchangeable” modification, but they are modifed only in case of new codes, in function of “non-interchangeable” modification. The complete code is mentioned on the electrical or topographic drawing of the same component.

COMPONENTS MNEMONIC LABELS TABLE

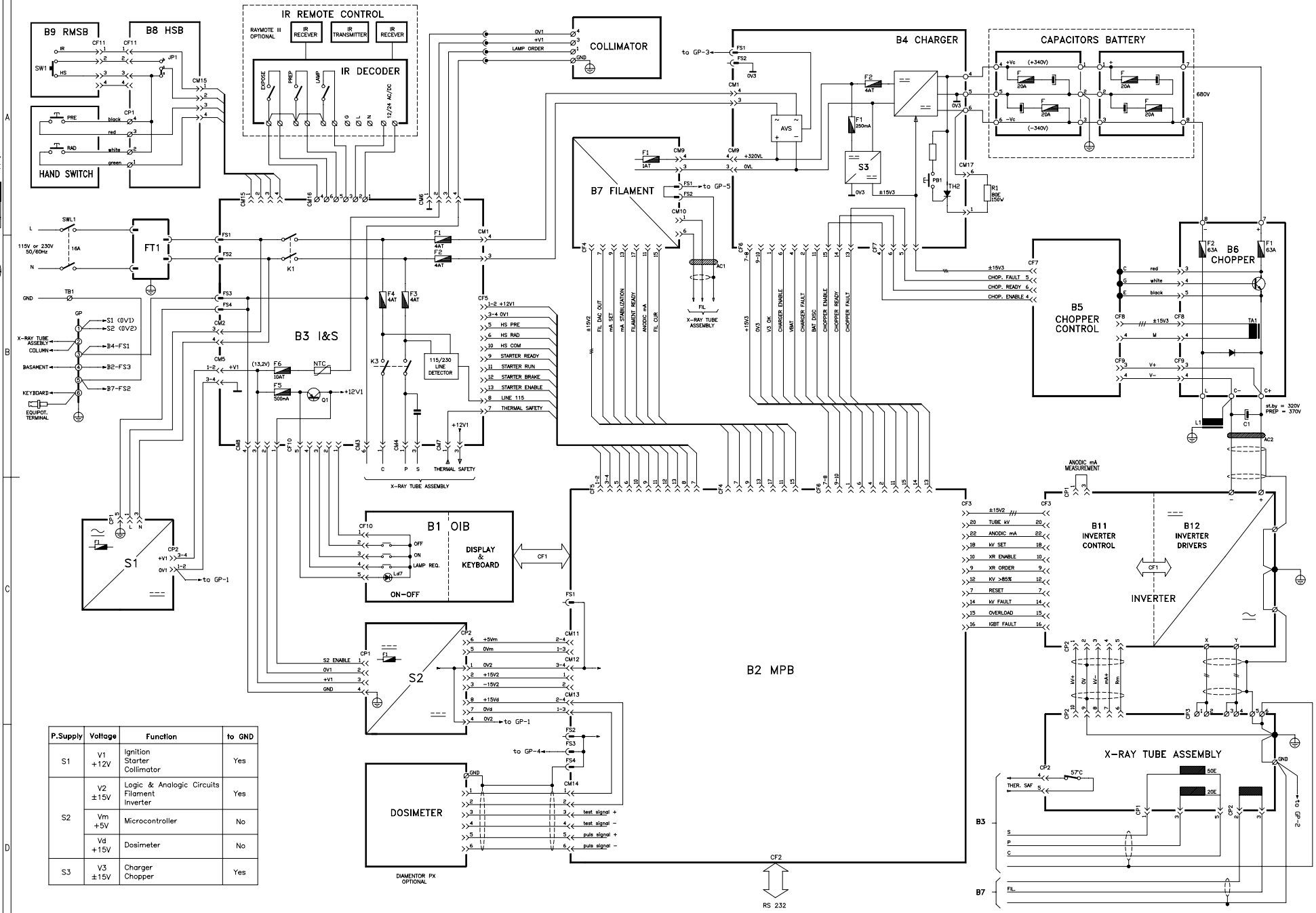
AC	Absorber core (shield bead)
AS	Switching power supply
AVS	Automatic Voltage Switch
AZ	Driver
B	Board
BR	Rectifier bridge
BT	Capacitors battery
BZ	Buzzer
C	Condenser
CF	Flat cable
CM	Multiple connector
CP	Pull connector
D	Diode
DF	Diode fast
DS	Suppression device
DZ	Zener diode
F	Fuse
FS	Signal filter
FT	Filter
GND	Ground
GP	Ground point
HS	Handswitch
IC	Integrated circuit
J	Faston
JP	Jumper
K	Relay
KB	Keyboard
L	Inductor
LCD	Display LCD
Ld	Led diode
LP	Lamp
OC	Optoisolator
P	Potentiometer – Trimmer
PB	Push-button
PM	Power device
Q	Transistor
R	Resistor
RN	Net resistor
S	Power supply
SCR	Thyristor
SW	Single switch - Double switch
SWL	Line switch
TA	Amperometric transformer
TH	Triac
Tp	Test point
TR	Transformer
VR	Voltage regulator
X	Quartz
ZC	Varistor

ASSEMBLY VIEW



DOCUMENTS STATUS

Rev.	*Date*	*Page/s*	*Modification description*
0			Document approval
1			
2			
3			
4			
5			



P.Supply	Voltage	Function	to GND
S1	V1 +12V	Ignition Starter Collimator	Yes
S2	V2 ±15V	Logic & Analogic Circuits Filament Inverter	Yes
	Vm +5V	Microcontroller	No
	Vd +15V	Dosimeter	No
S3	V3 ±15V	Charger Chopper	Yes

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Drawing code / Disegno codice : 05640
File location / Posizione File : ..

DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
UNIT GENERAL DIAGRAM					P.Facoetti				PRACTIX 100 plus	05640	
					DATE 02-02-00	DATE	DATE	REPLACE BY	DRAWING TYPE Functional	BOARD REFERENCE	SHEET REV.

TECHNIX

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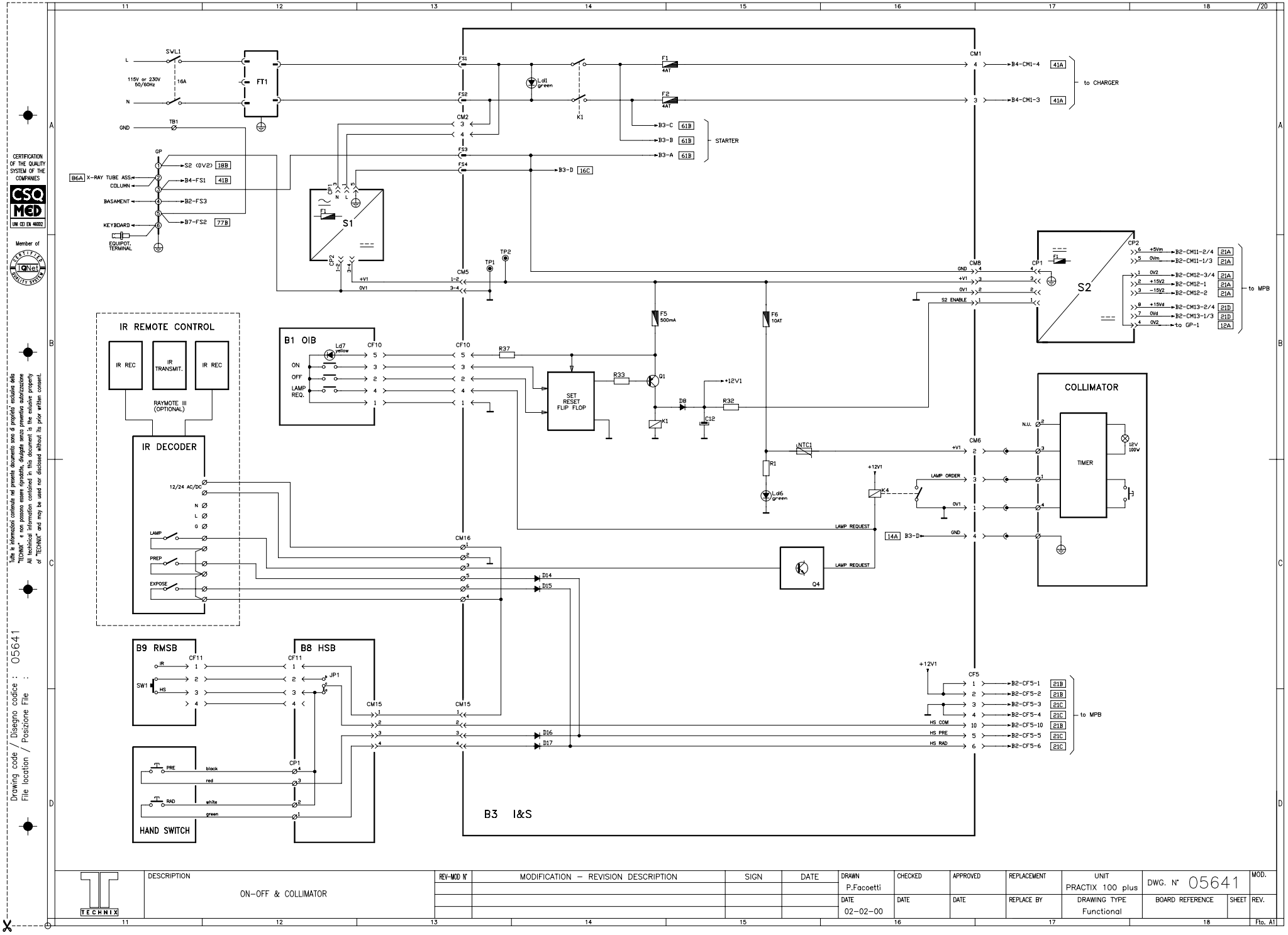

TECHNIX	DESCRIPTION: ON-OFF & COLLIMATOR	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN: P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT: PRACTIX 100 plus	DWG. N°: 05641	MOD.
						DATE: 02-02-00	DATE	DATE	REPLACE BY	DRAWING TYPE: Functional	BOARD REFERENCE	SHEET / REV.

Drawing code / Disegno codice : 05641
File location / Posizione File : :

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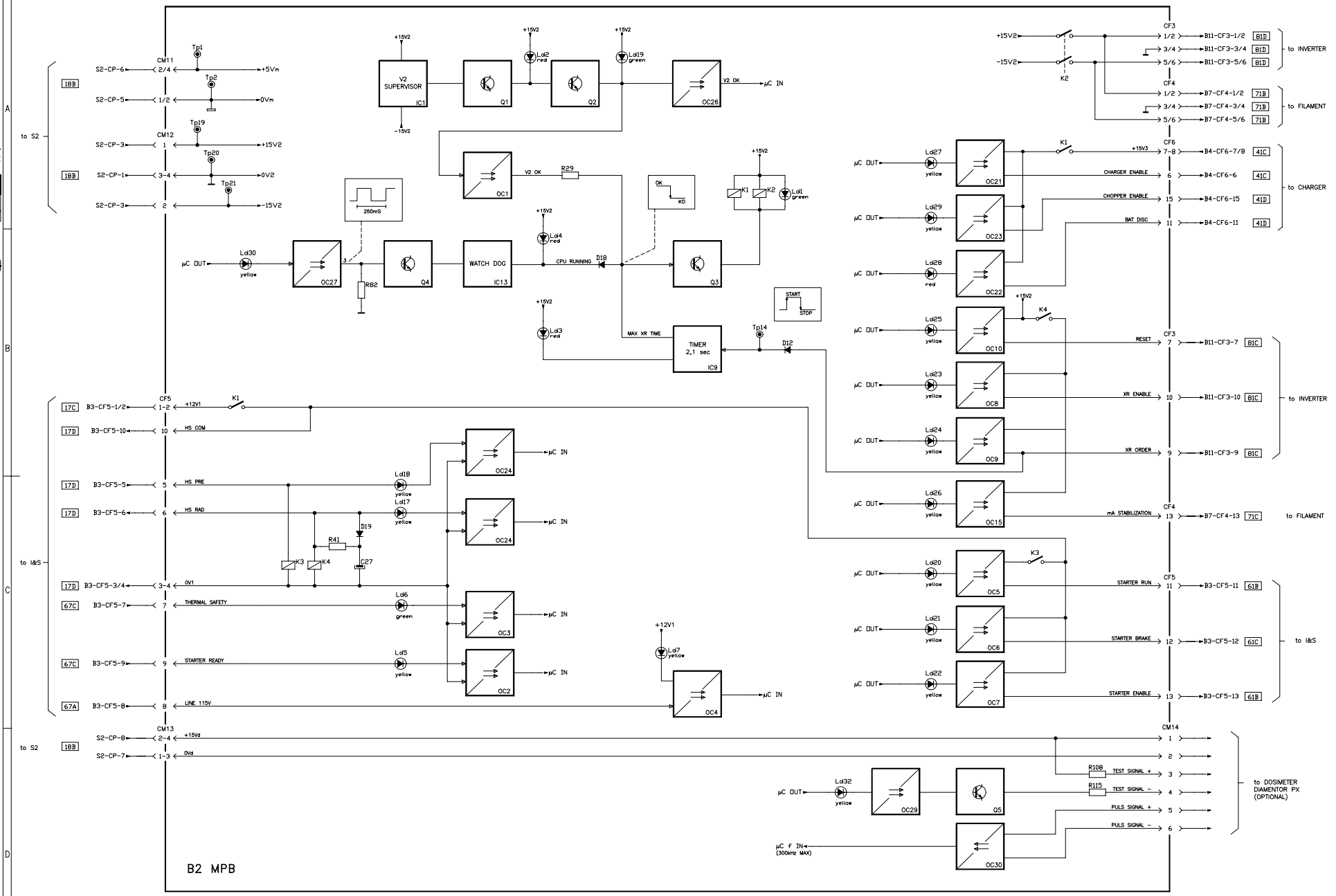

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	MPB POWER SUPPLY – HARDWARE SAFETY – DOSIMETER					P.Facoetti				PRACTIX 100 plus		
						DATE 13-12-99	DATE	DATE	REPLACE BY	DRAWING TYPE Functional	BOARD REFERENCE	SHEET REV.

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Drawing code / Disegno codice : 05642
File location / Posizione File : .

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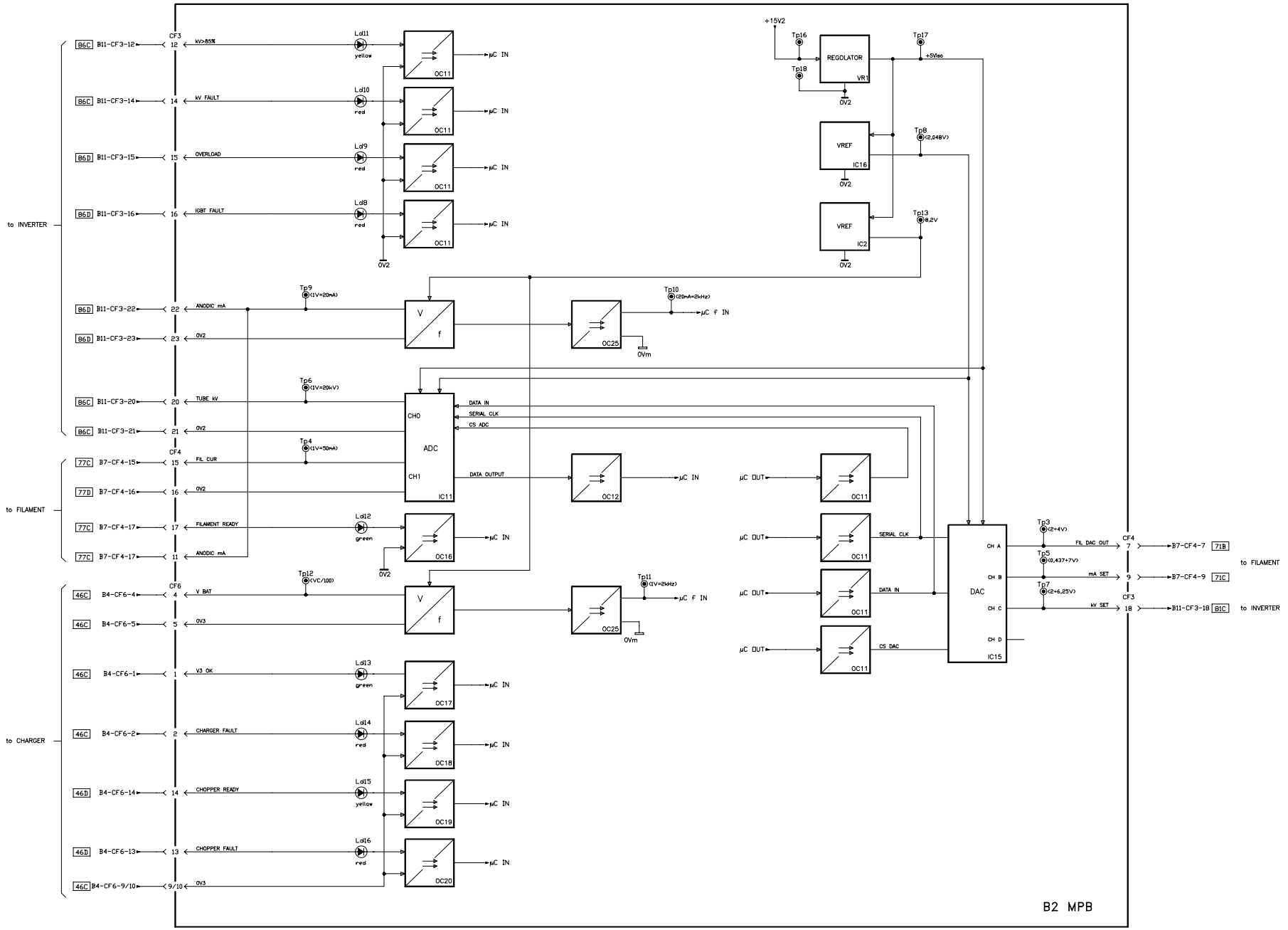

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Drawing code / Disegno codice : 05643
File location / Posizione File : .

TECHNIX	DESCRIPTION: MPB INPUTS & CONVERTERS (ADC – DAC – V/F)	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN: P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT: PRACTIX 100 plus	DWG. N° 05643	MOD.
						DATE: 13-12-99	DATE	DATE	REPLACE BY	DRAWING TYPE: Functional	BOARD REFERENCE	SHEET / REV.

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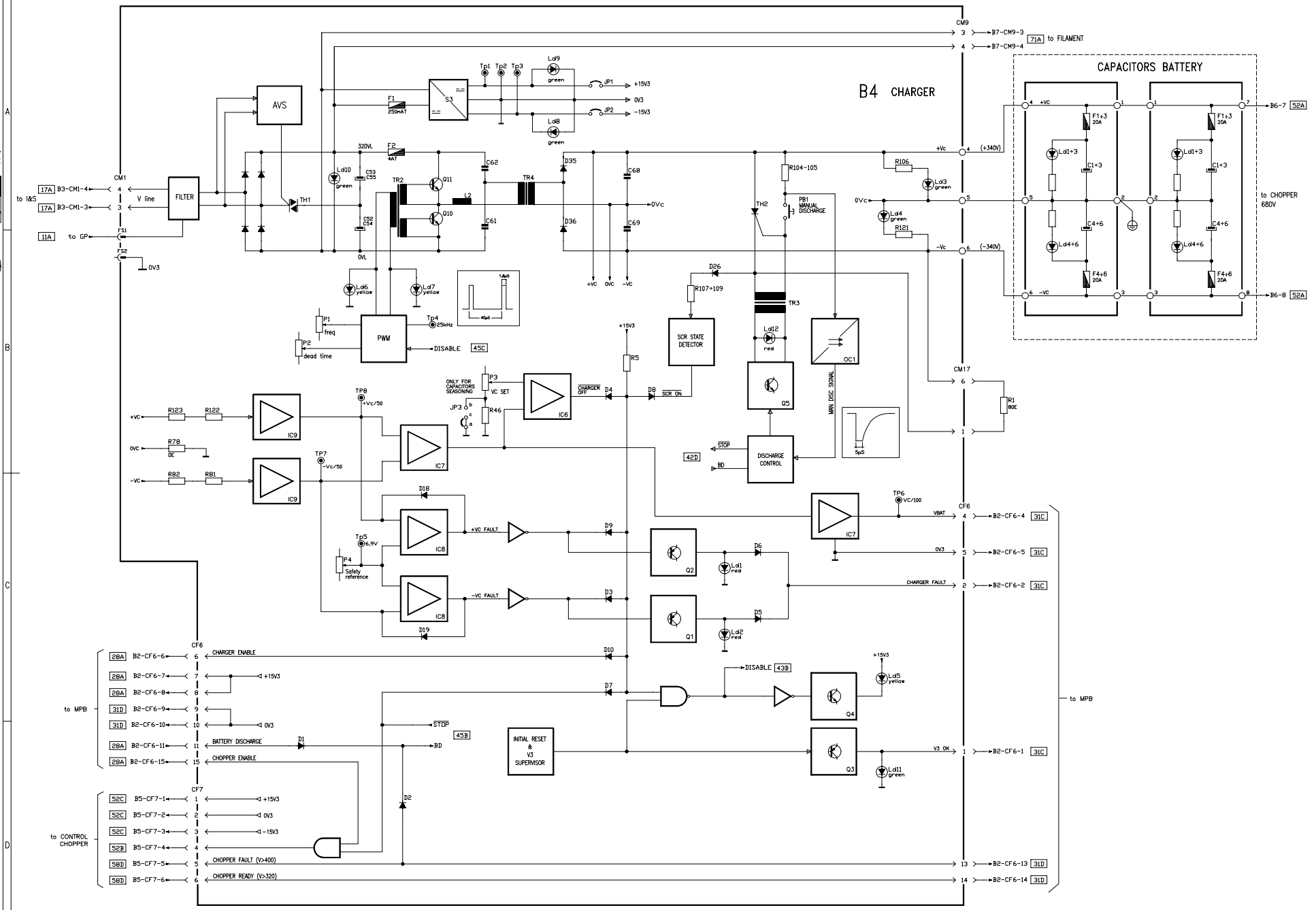

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Drawing code / Disegno codice : 05644
File location / Posizione File : ..

DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
CHARGER & CAPACITORS BATTERY					P.Facoetti				PRACTIX 100 plus	05644	
					DATE 13-12-99	DATE	DATE	REPLACE BY	DRAWING TYPE Functional	BOARD REFERENCE	SHEET REV.

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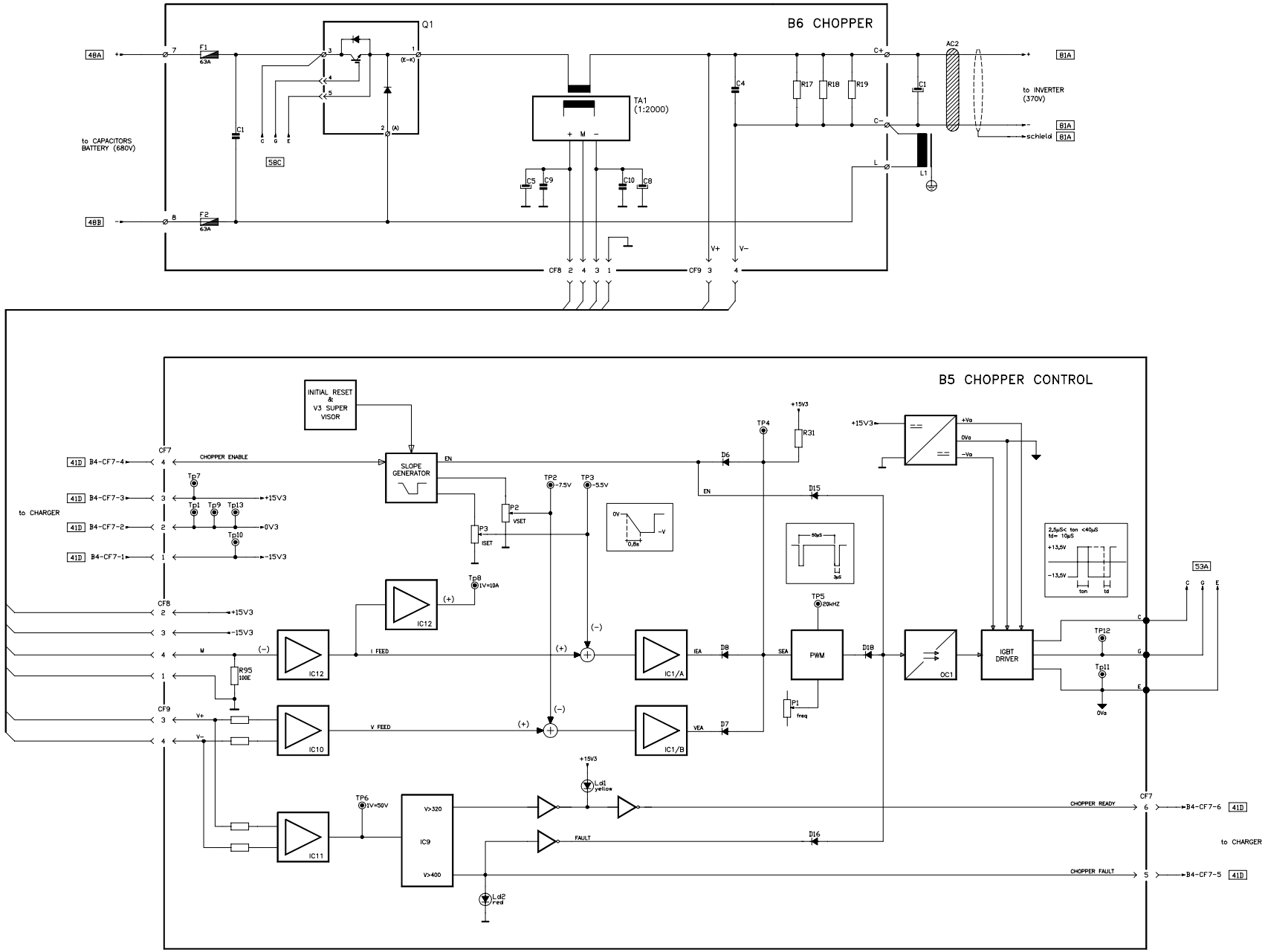

TECHNIX	DESCRIPTION: CHOPPER CONTROL & CHOPPER	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN: P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT: PRACTIX 100 plus	DWG. N° 05645	MOD.
						DATE: 13-12-99	DATE	DATE	REPLACE BY	DRAWING TYPE: Functional	BOARD REFERENCE	SHEET / REV.

Drawing code / Disegno codice : 05645
File location / Posizione File : :

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Drawing code / Disegno codice : 05646
File location / Posizione File :

B3 I&S

Ld2	Line
ON	230V
OFF	115V

V.LINE	K2	PRINC		SHIFT	
		GAIN IC1/A	TP6 Vpk	GAIN IC1/B	TP3 Vpk
87 115	OFF	68	9,4V 10,0V	90	9,4V 10,0V
195 230	ON	33	9,4V 9,8V	40	9,4V 9,8V

DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
STARTER					P.Facoetti				PRACTIX 100 plus	05646	
					DATE 13-12-99	DATE	DATE	REPLACE BY	DRAWING TYPE Functional	BOARD REFERENCE	SHEET REV.

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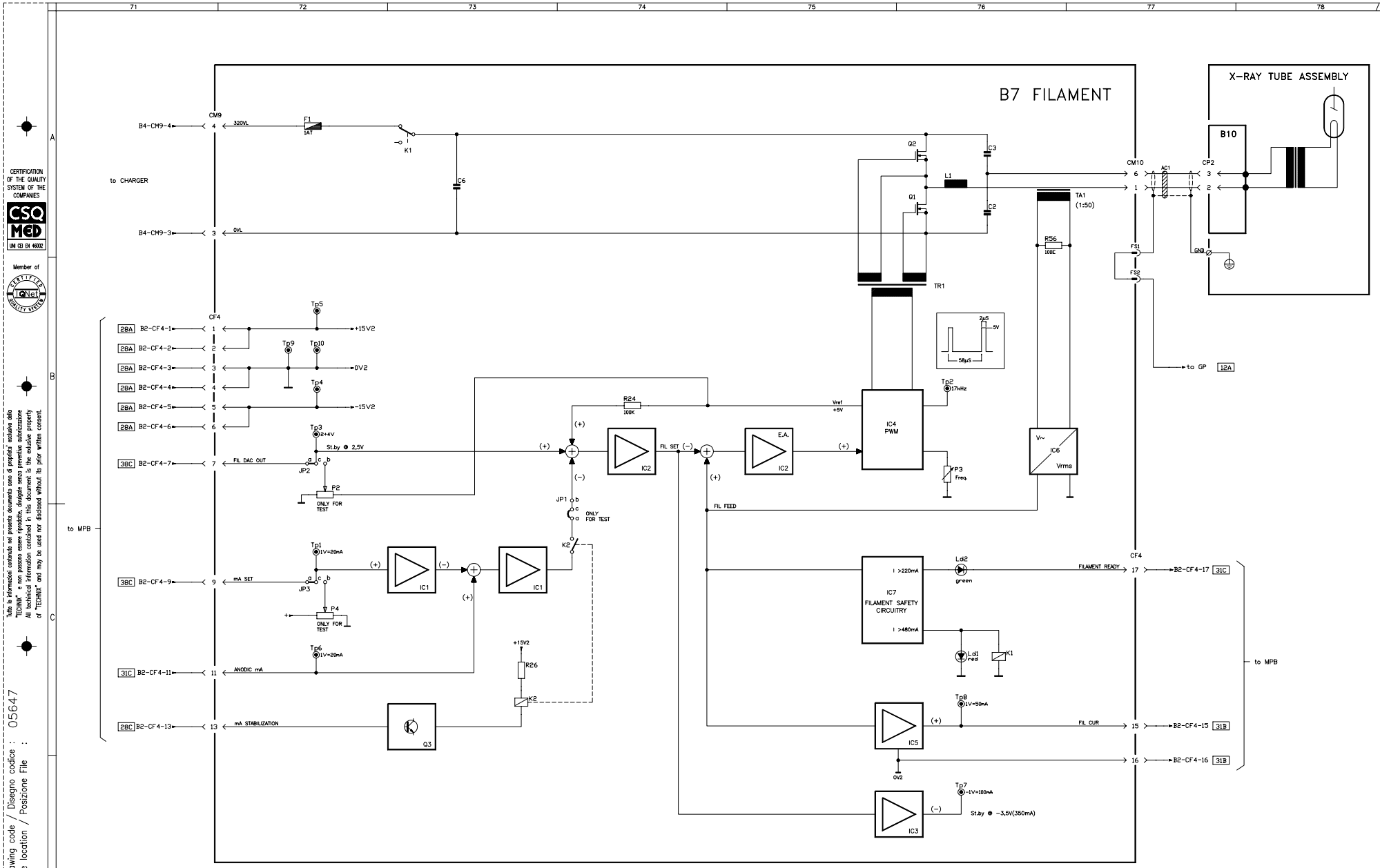

	DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
TECHNIX	FILAMENT					P.Facoetti				Practix 100 plus	05647	
						DATE 13-12-99	DATE	DATE	REPLACE BY	DRAWING TYPE	BOARD REFERENCE	SHEET REV.

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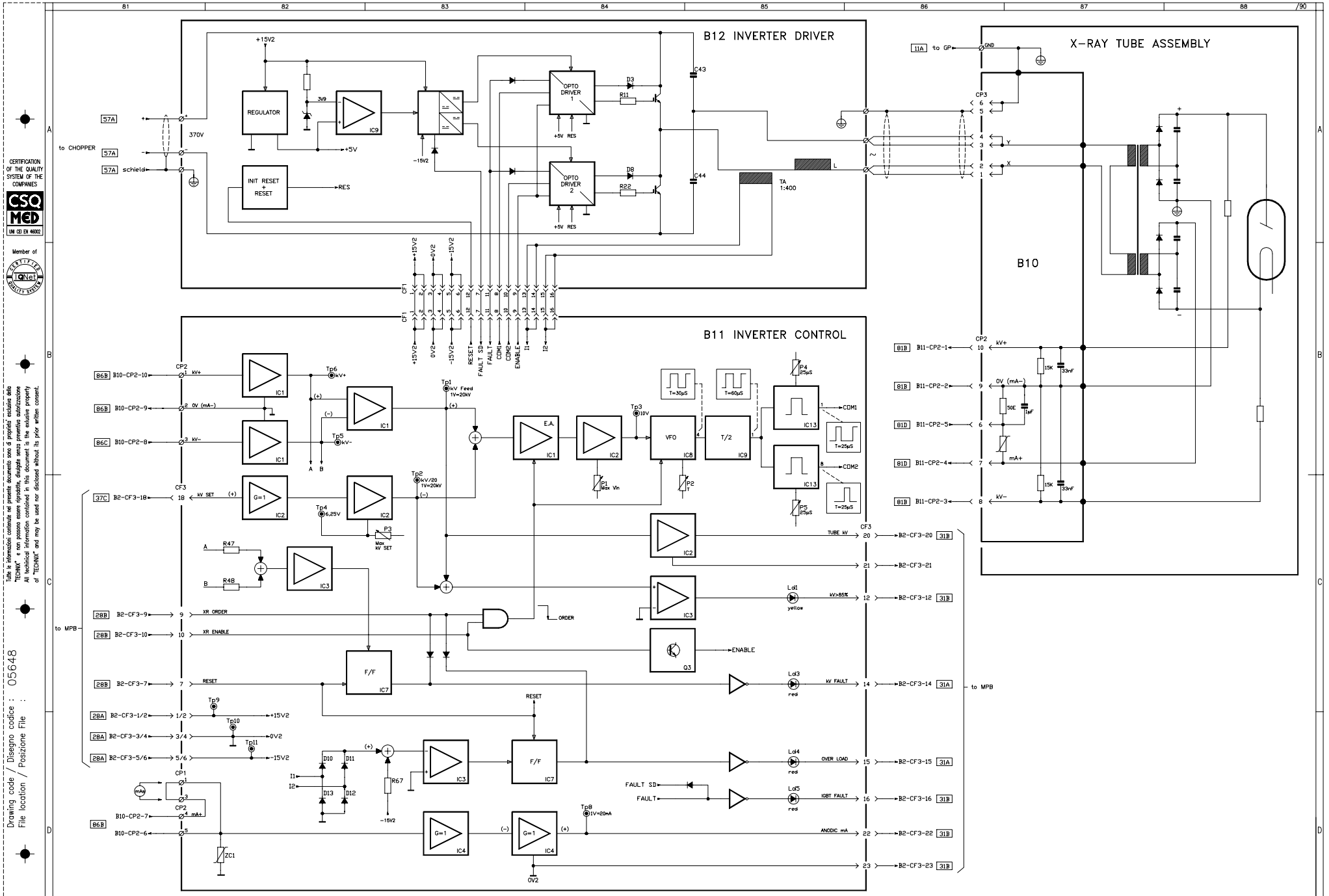
Drawing code / Disegno codice : 05647
File location / Posizione File : ..



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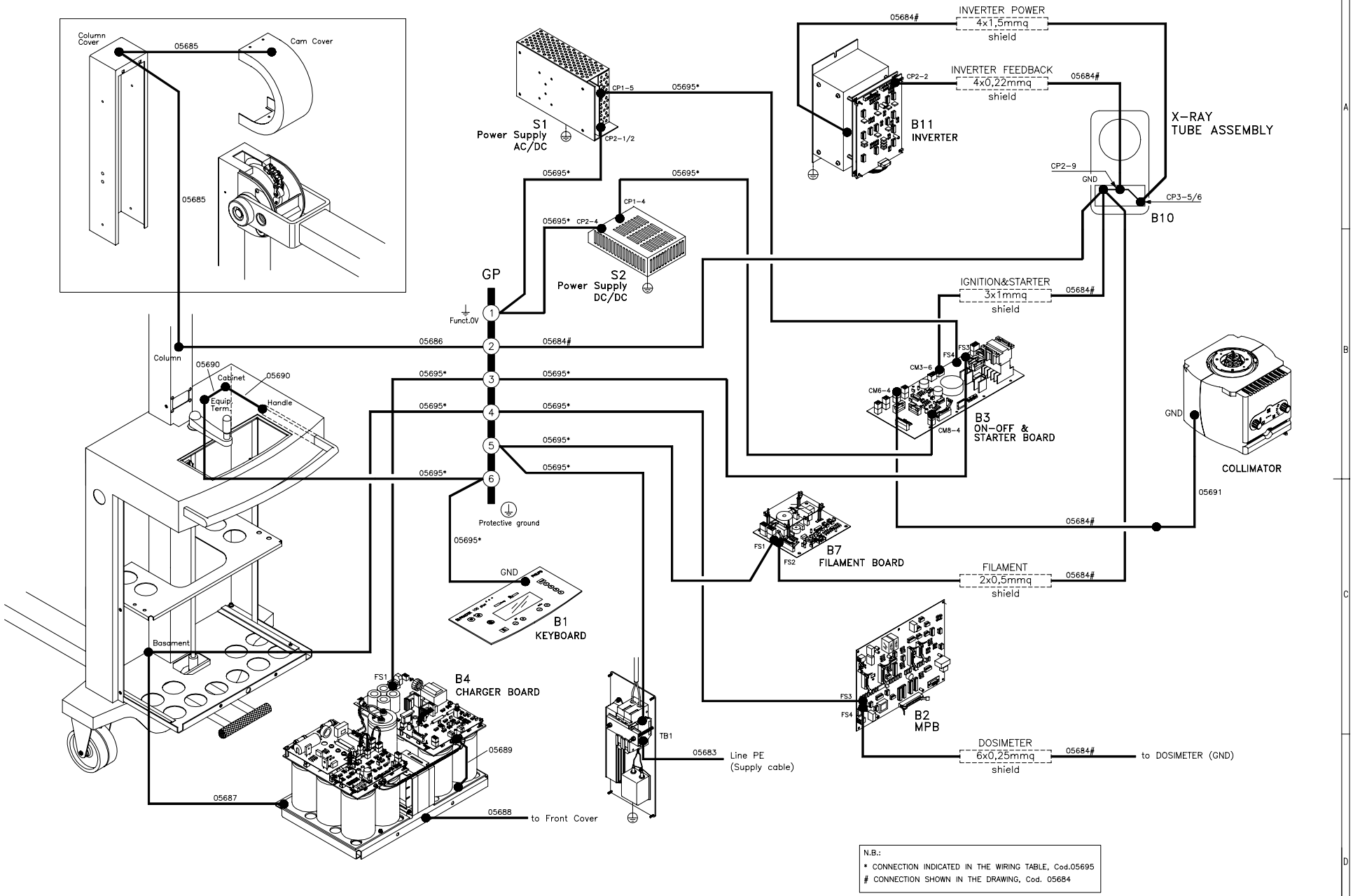
Drawing code / Disegno codice : 05648
File location / Posizione File : .

TECHNIX	DESCRIPTION: INVERTER	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN: P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT: PRACTIX 100 plus	DWG. N° 05648	MOD.
						DATE: 13-12-99	DATE	DATE	REPLACE BY	DRAWING TYPE: Functional	BOARD REFERENCE	SHEET REV.

Fto. A1



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Drawing code / Disegno codice : 05649
File location / Posizione File :

DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
GROUNDING GROUNDING					P.Facoetti				PRACTIX 100 plus	05649	
					DATE	DATE	DATE	REPLACE BY	DRAWING TYPE	BOARD REFERENCE	SHEET / REV.
					02-02-00				Topographic		

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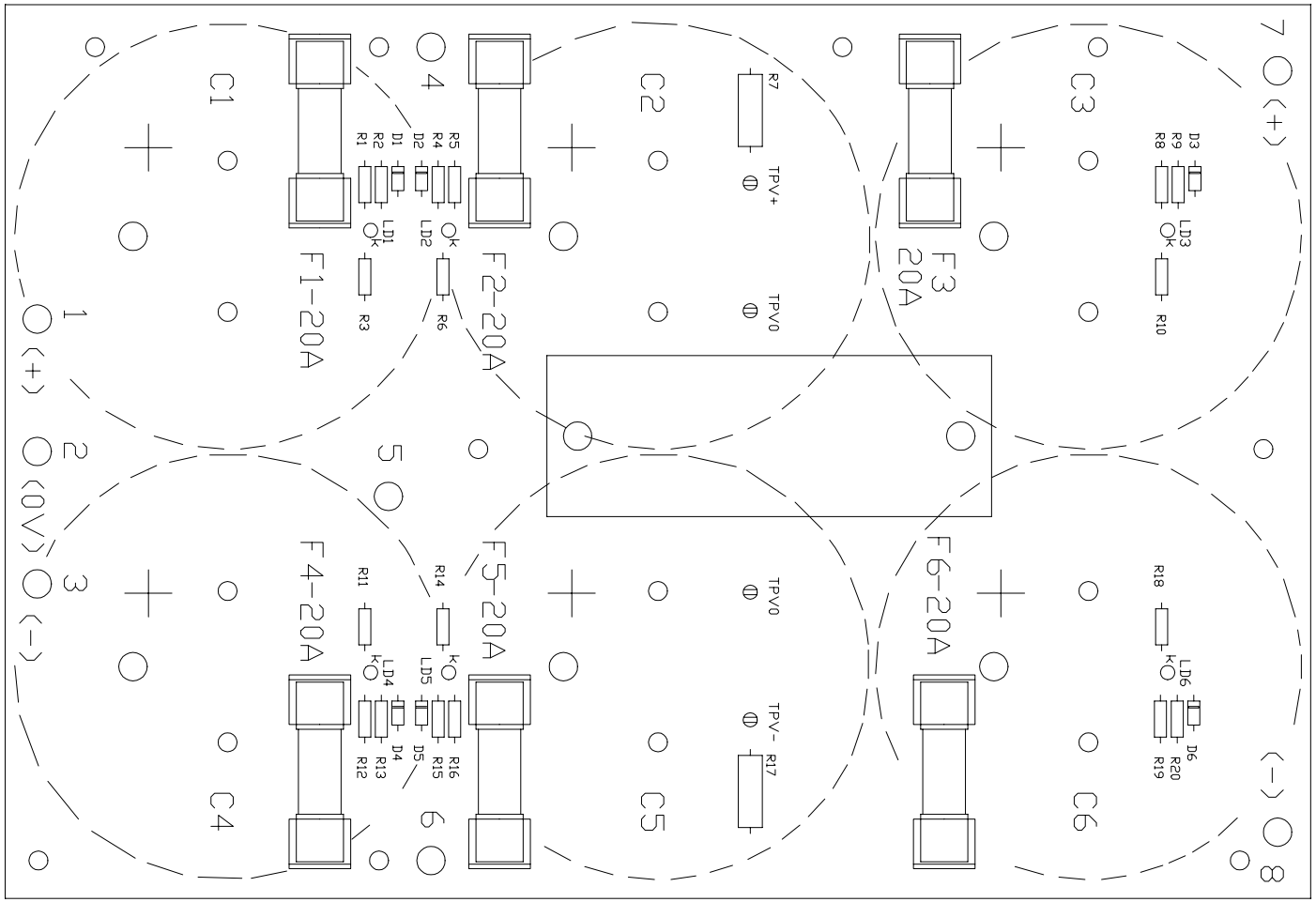
Drawing code / Disegno codice : 01642
File location / Posizione File :



DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01642	MOD.
SCHEDA BATTERIA DI CONDENSATORI CAPACITORS BATTERY CARD					P.Facoetti						
TECHNIX					DATE 10-03-99	DATE	DATE	REPLACED BY	DRAWING TYPE	BOARD REFERENCE / SHEET / REV.	

F.to A3

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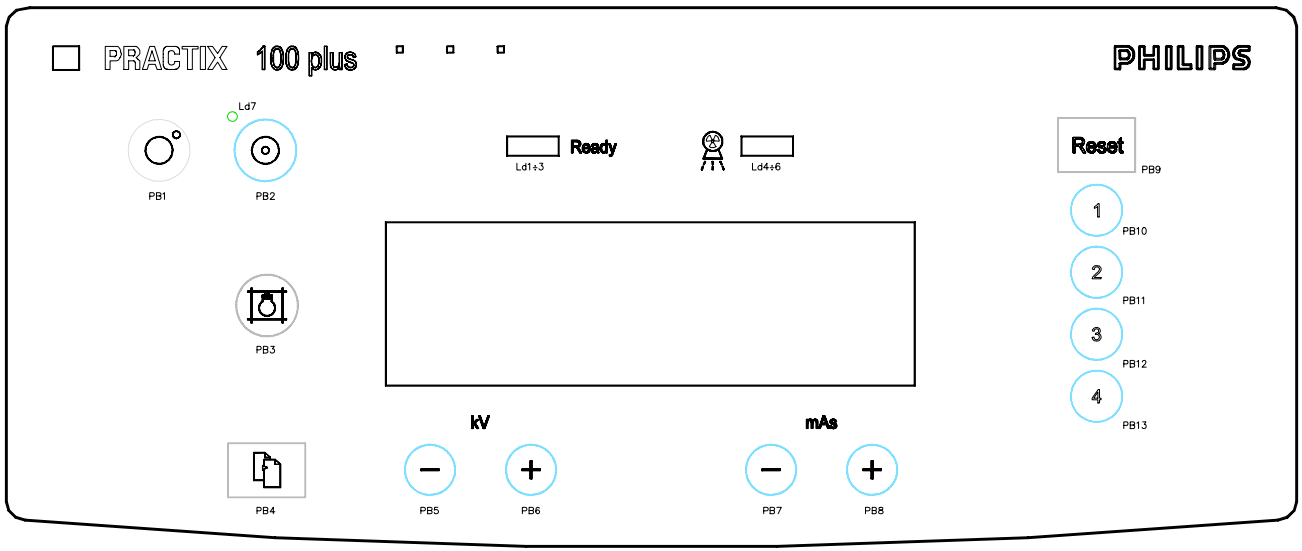
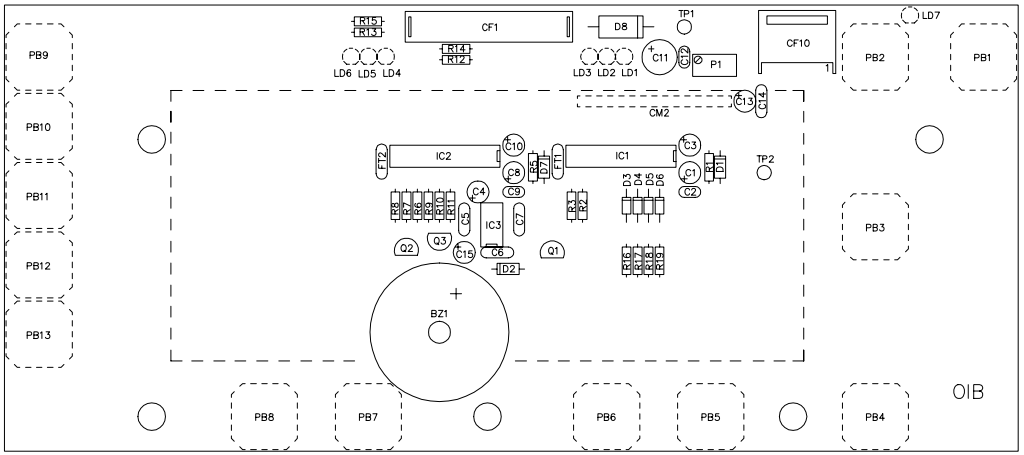
File location / Posizione File :



KEYBOARD SIDE



COMPONENTS SIDE

TECHNIX	DESCRIPTION B1 – OIB SCHEDA INTERFACCIA OPERATORE B1 – OIB OPERATOR INTERFACE BOARD	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT PRACTIX 100plus	DWG. N° 01640 MOD.
						DATE 14-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE / SHEET / REV.

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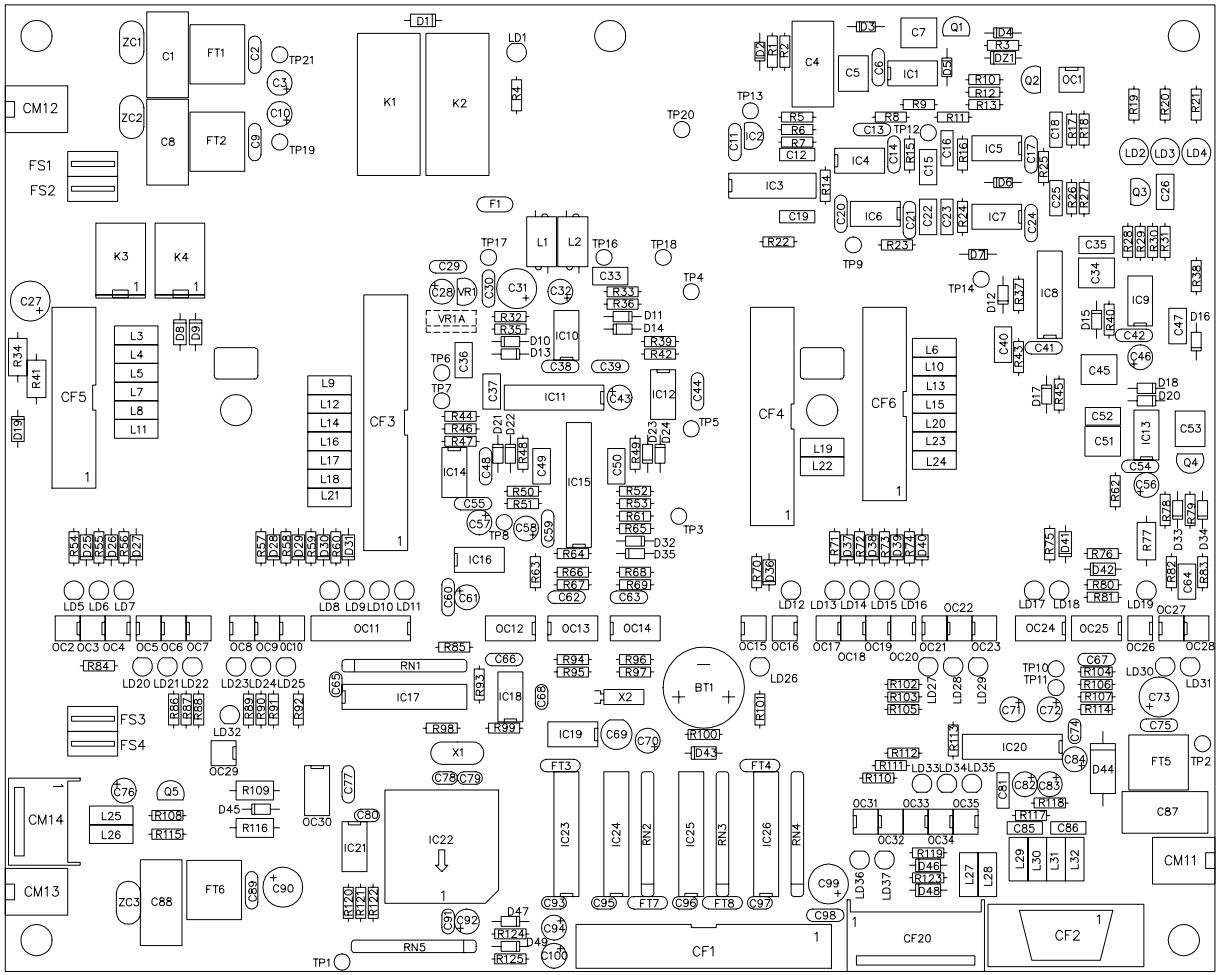
File location / Posizione File :



DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
B2 – MPB SCHEDA GESTIONE PROCESSORE B2 – MPB MANAGEMENT PROCESSOR BOARD					P.Facoetti				PRACTIX 100plus	01641	
					DATE	DATE	DATE	REPLACED BY	DRAWING TYPE	BOARD REFERENCE	SHEET / REV.
					14-10-99				Topographic		

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F.to A3

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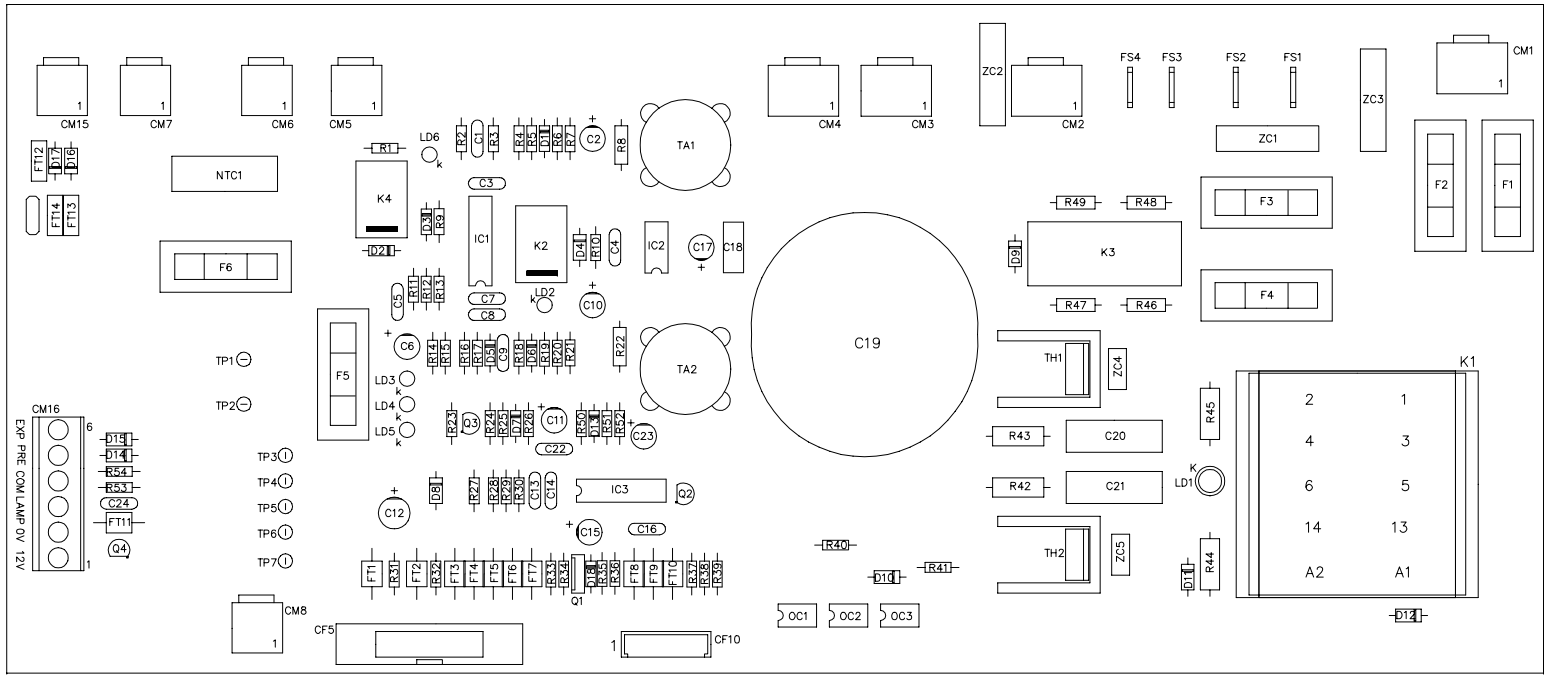
Drawing code / Disegno codice : 01646
File location / Posizione File :



TECHNIX	DESCRIPTION B3 – SCHEDA ON-OFF & STARTER B3 – ON-OFF & STARTER BOARD	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01646		MOD.
						DATE 20-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE	SHEET	REV.

F.to A3

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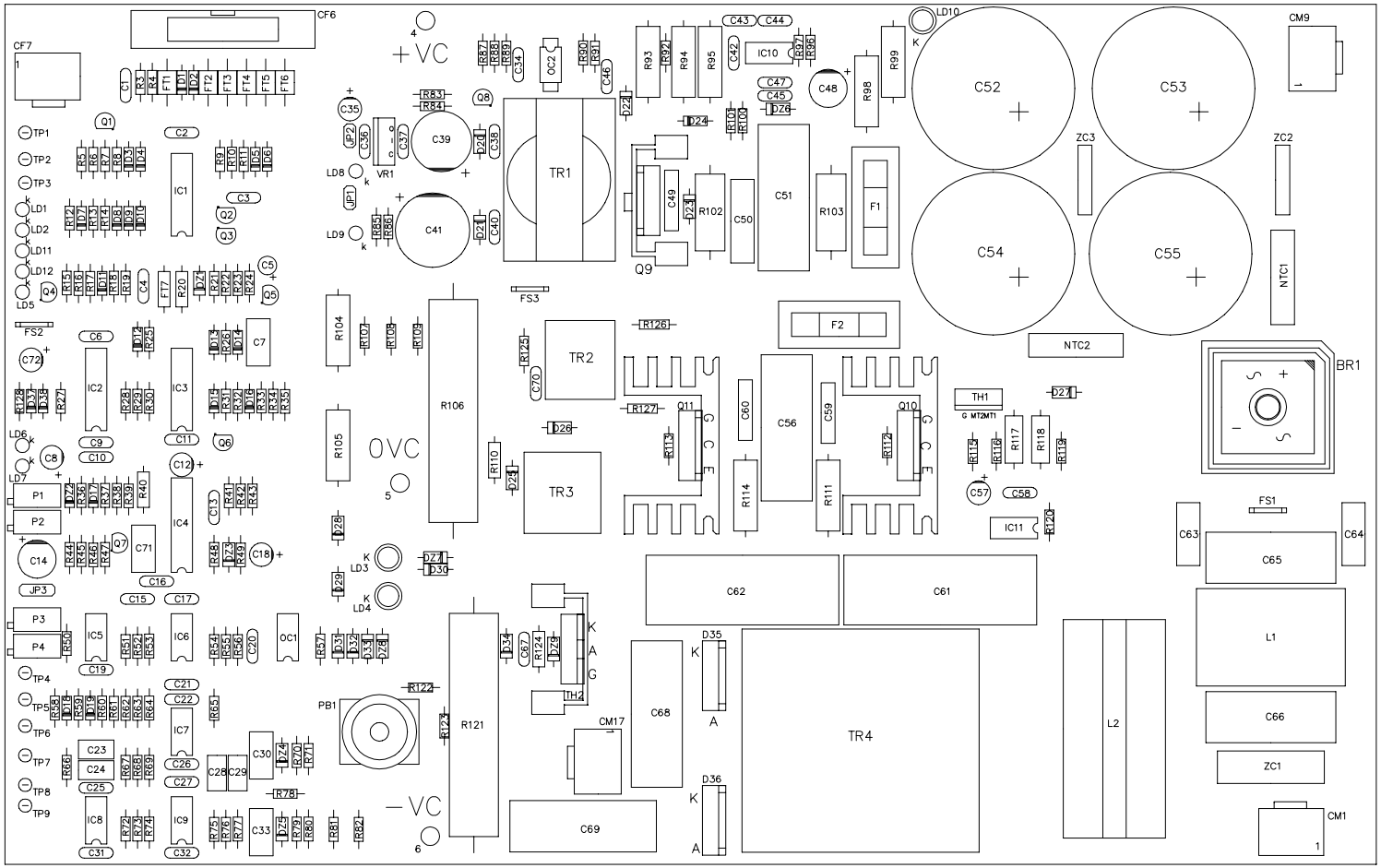
Drawing code / Disegno codice : 01643
File location / Posizione File :



DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
B4 CHARGER CARD B4 CHARGER CARD					P.Facoetti					01643	
					DATE 20-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE	SHEET REV.

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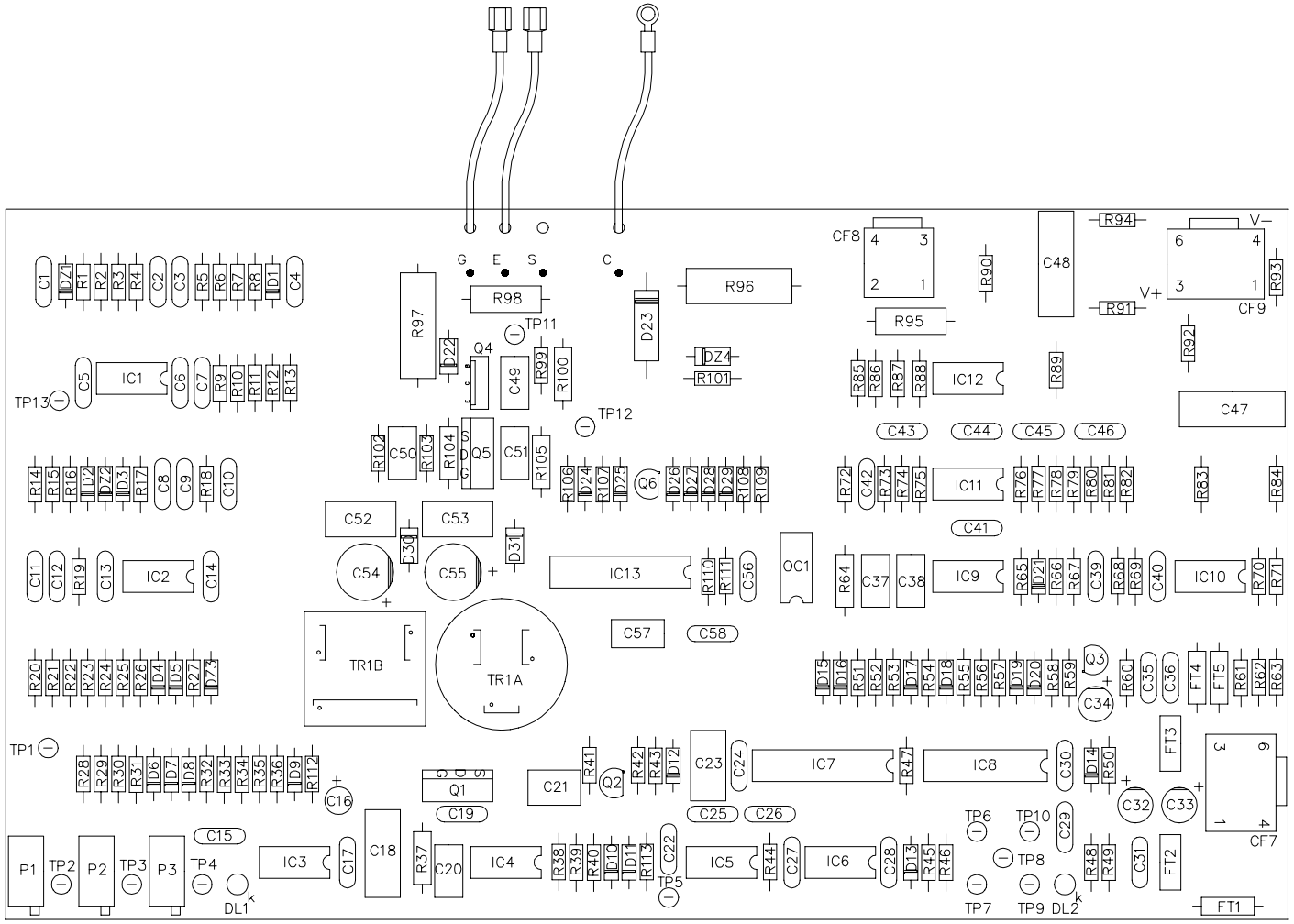
Drawing code / Disegno codice : 01644
File location / Posizione File :



TECHNIX	DESCRIPTION B5 CONTROL CHOPPER CARD B5 CONTROL CHOPPER CARD	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01644	MOD.
						DATE 30-09-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE	SHEET / REV.

F.to A3

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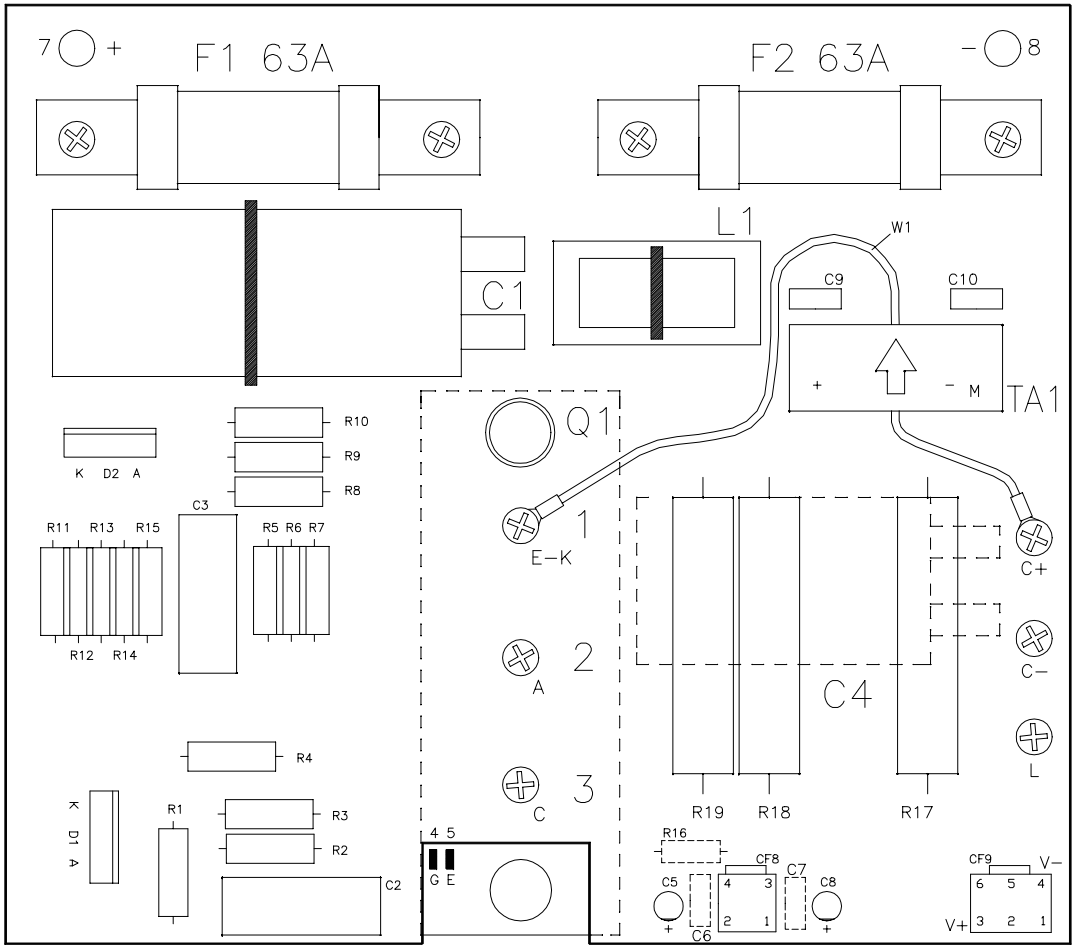
Drawing code / Disegno codice : 01645
File location / Posizione File :



TECHNIX	DESCRIPTION B6 CHOPPER CARD B6 CHOPPER CARD	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01645		MOD.
						DATE 20-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE	SHEET	REV.

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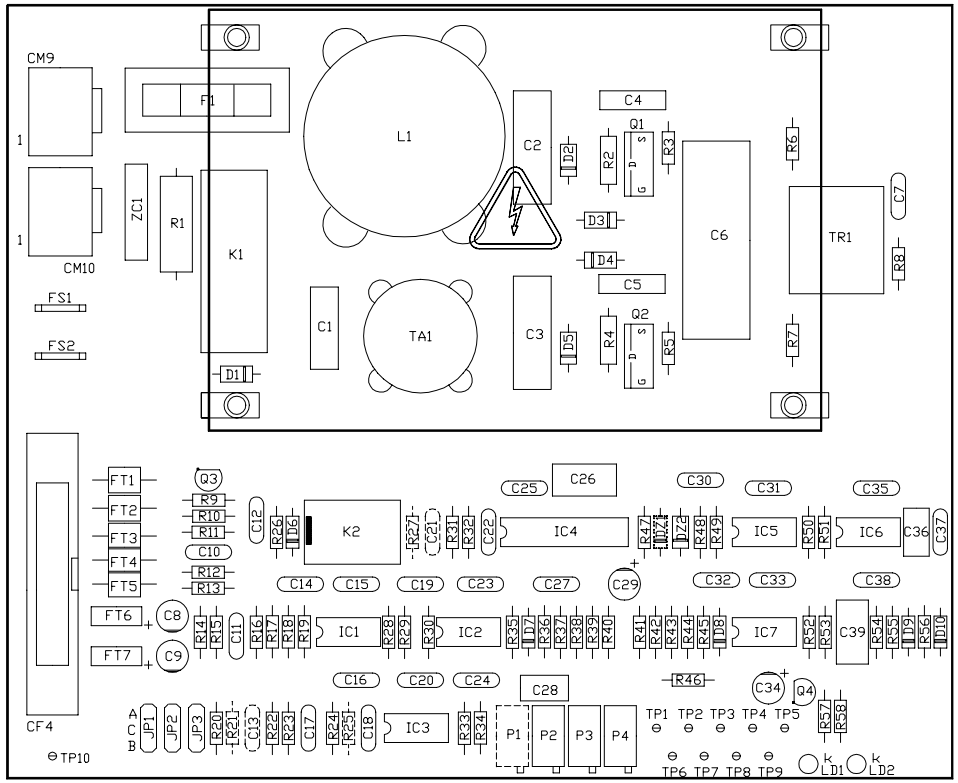
Drawing code / Disegno codice : 01647
File location / Posizione File :



TECHNIX	DESCRIPTION B7 – SCHEDA FILAMENTO B7 – FILAMENT BOARD	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01647		MOD.
						DATE 21-03-00	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE	SHEET	REV.

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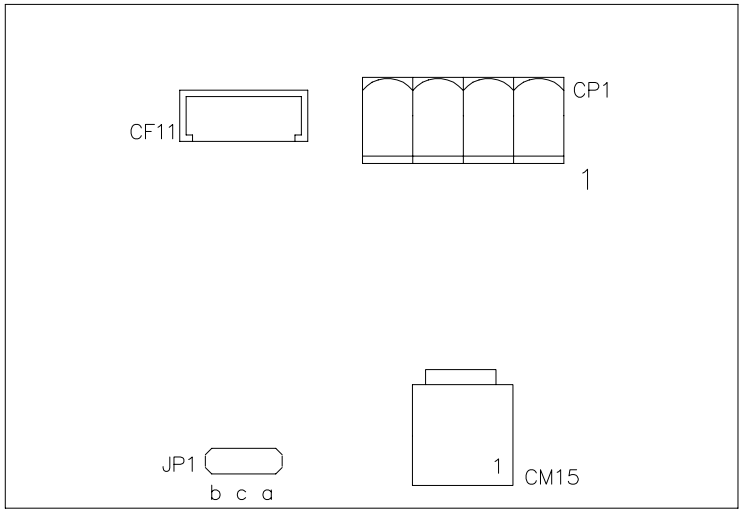
Drawing code / Disegno codice : 01648
File location / Posizione File :



TECHNIX	DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01648		MOD.						
	B8 – HAND SWITCH BOARD					P.Facoetti													
						DATE	DATE	DATE	REPLACED BY	DRAWING TYPE	BOARD REFERENCE		SHEET	REV.					
						30-09-99				Topographic									

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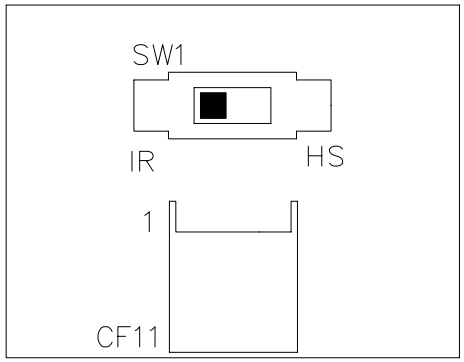
Drawing code / Disegno codice : 01649
File location / Posizione File :



TECHNIX	DESCRIPTION: B9 – REALISE MODE SWITCH BOARD	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN: P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01649		MOD.
						DATE: 20-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE: Topographic	BOARD REFERENCE	SHEET	REV.

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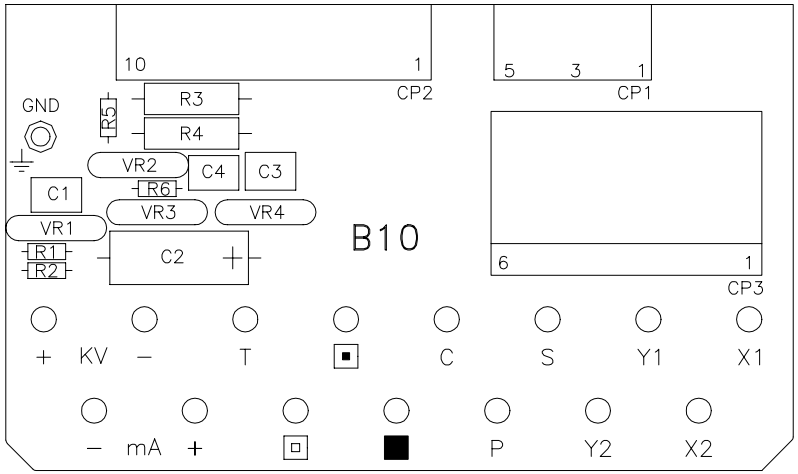
Drawing code / Disegno codice : 01735
File location / Posizione File :



CP1	
1	SHIFT
2	N.U.
3	PRINC
4	NU.
5	COM

CP2	
1	N.U.
2	FILAM.
3	FILAM.
4	TH. SAFETY
5	TH. SAFETY
6	Rm
7	mA+
8	kV–
9	mA– (GND)
10	kV+

CP3	
1	X1
2	X2
3	Y1
4	Y2
5	⏚
6	⏚

TECHNIX

DESCRIPTION: B10 – X-RAY TUBE ASSEMBLY BOARD

REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE

DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01735	MOD.
P.Facoetti						
DATE 20-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE / SHEET	REV.

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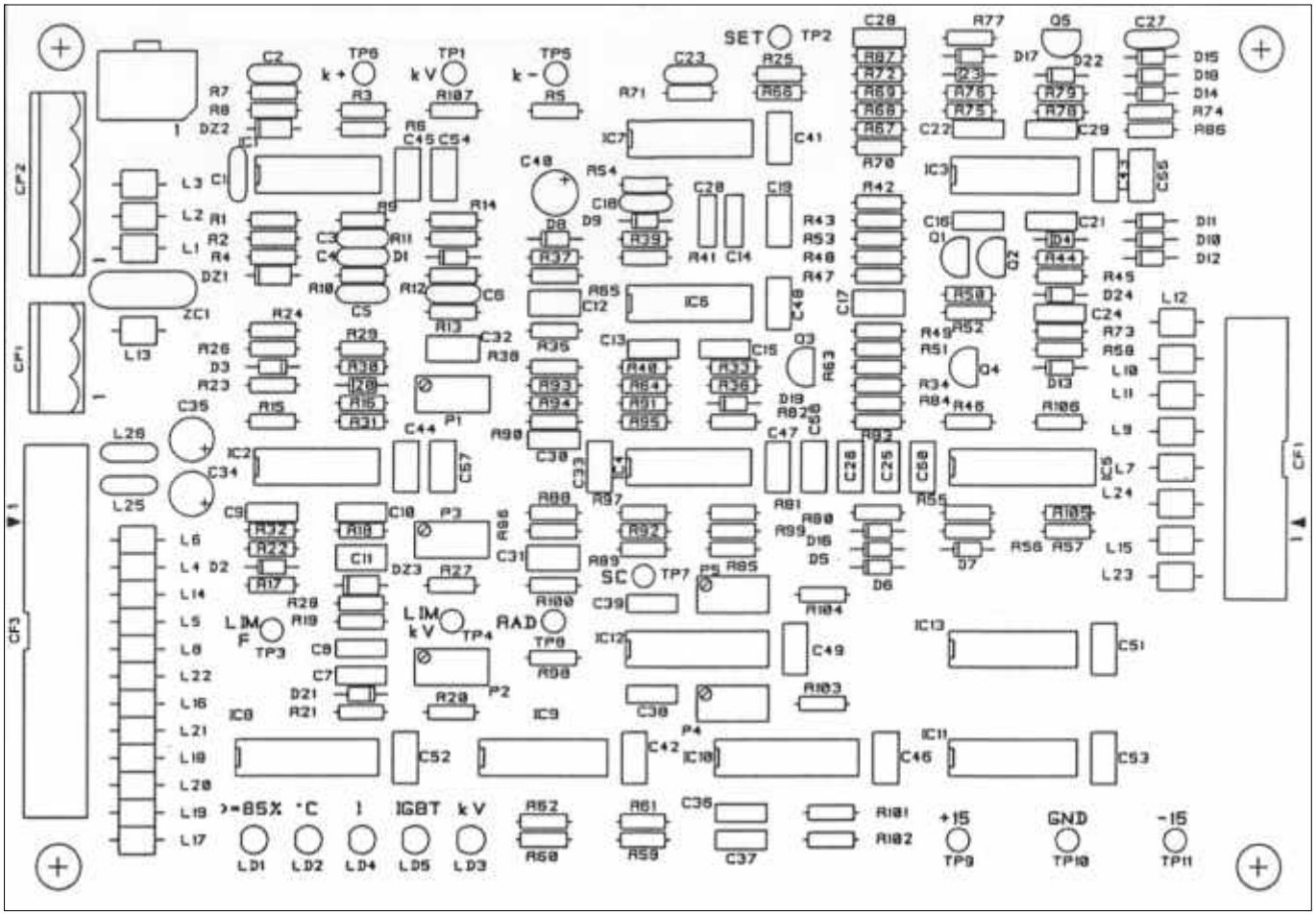
Drawing code / Disegno codice : 01736
File location / Posizione File :



TECHNIX	DESCRIPTION: B11 – INVERTER CONTROL BOARD (ICB)	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN: P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 01736	MOD.
						DATE: 20-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE: Topographic	BOARD REFERENCE / SHEET / REV.	

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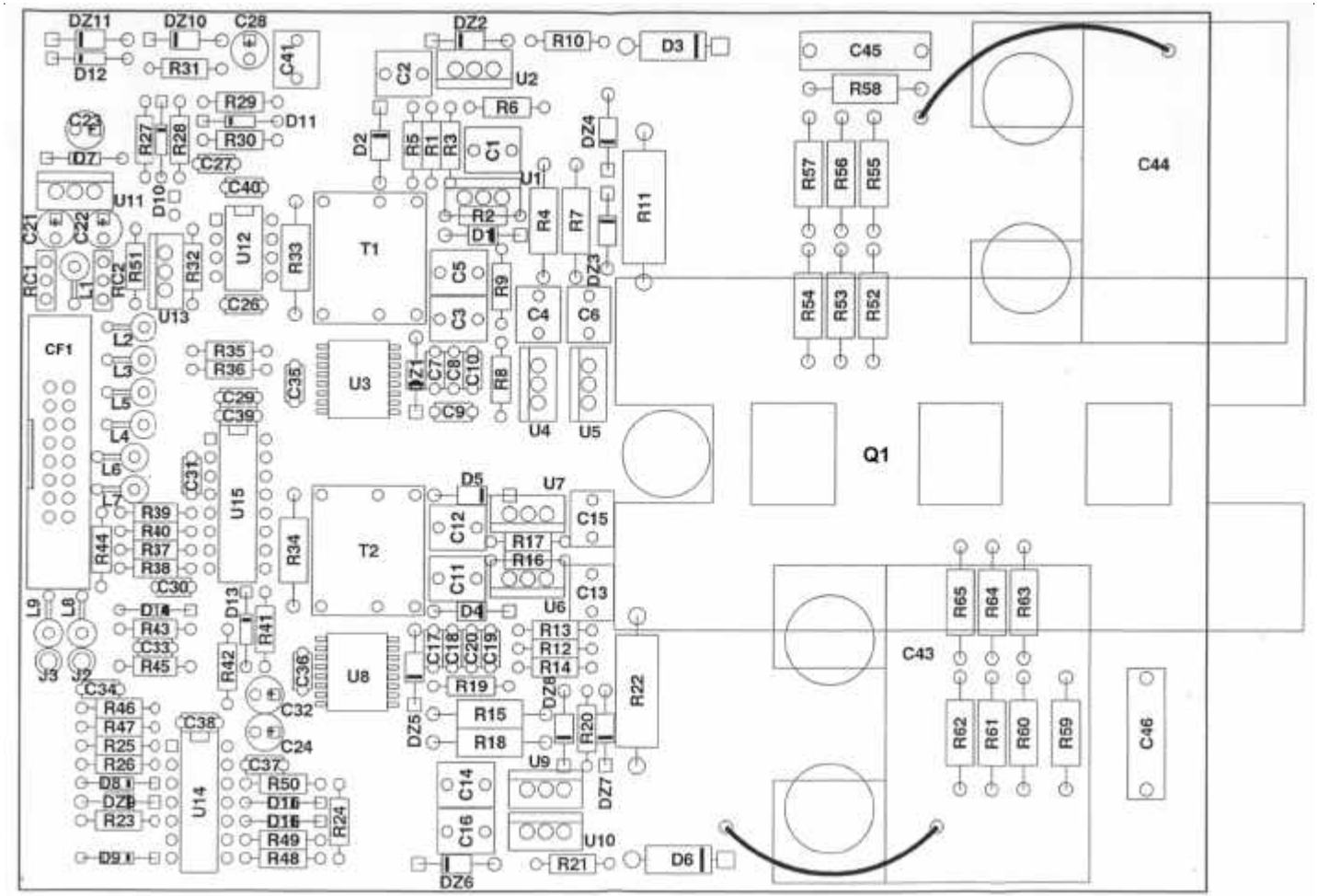
Drawing code / Disegno codice : 01737
File location / Posizione File :



DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
B12 – INVERTER DRIVERS BOARD (IDB)					P.Facoetti				PRACTIX 100plus	01737	
					DATE	DATE	DATE	REPLACED BY	DRAWING TYPE	BOARD REFERENCE	SHEET / REV.
					22-10-99				Topographic		

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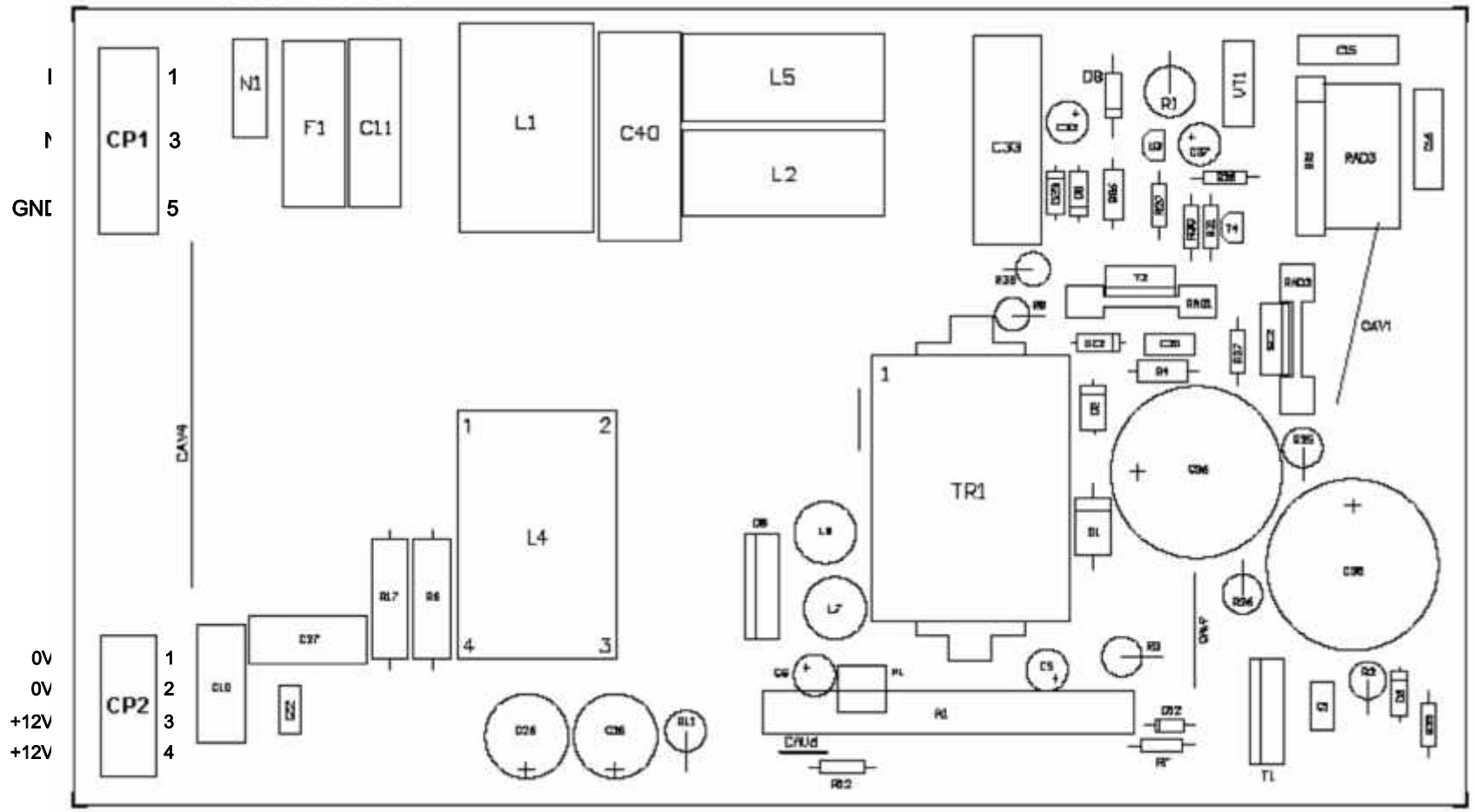
Drawing code / Disegno codice : 11858
File location / Posizione File :

FUSE TYPE T5A



DESCRIPTION: S1 – POWER SUPPLY AC/DC BOARD Mod. MPS 150-12	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN P.Facoetti	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N° 11858	MOD.
					DATE 27-12-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE	SHEET / REV.

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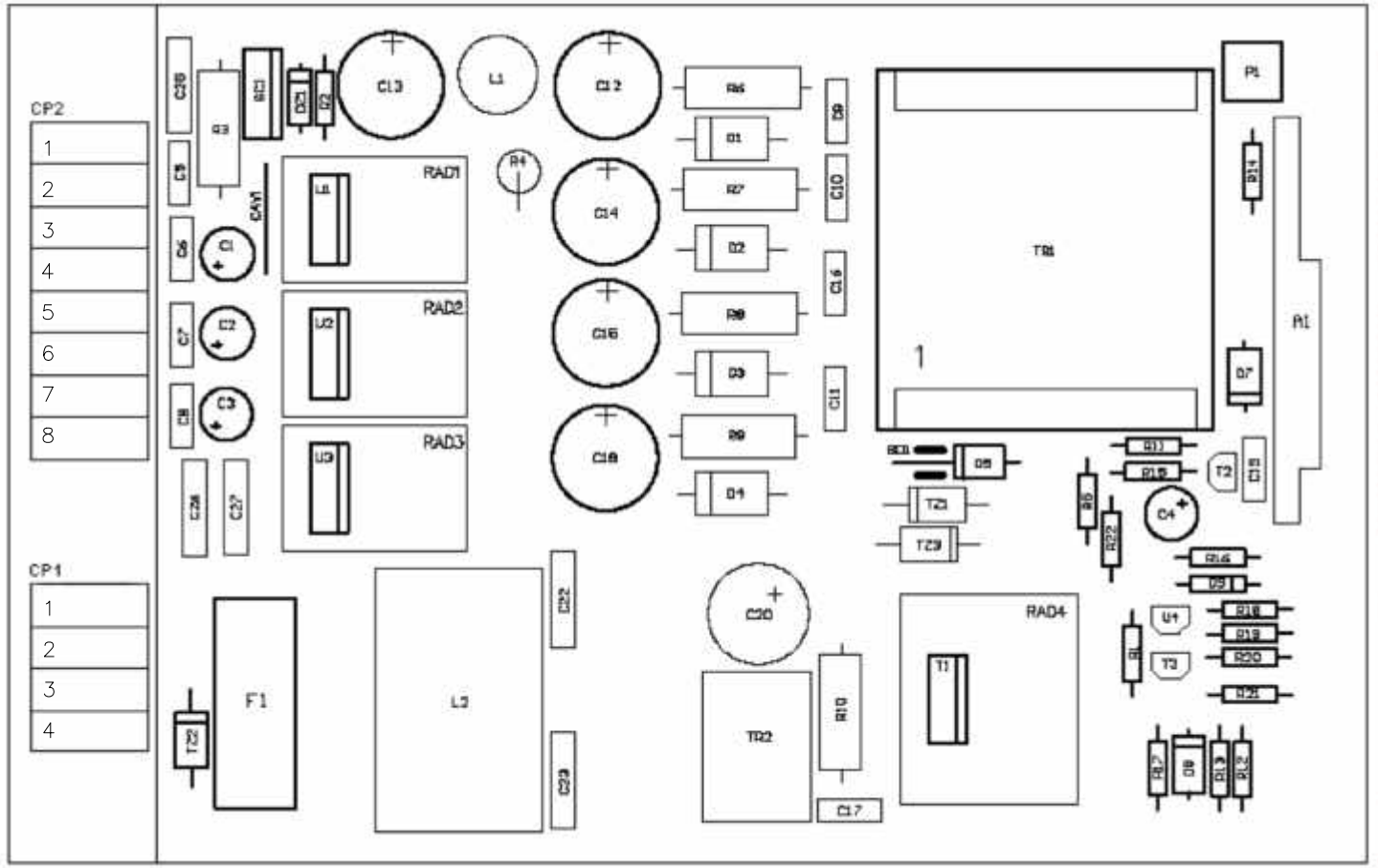
Drawing code / Disegno codice : 11859
File location / Posizione File :



FUSE TYPE T5A

DESCRIPTION	REV-MOD N°	MODIFICATION – REVISION DESCRIPTION	SIGN	DATE	DRAWN	CHECKED	APPROVED	REPLACEMENT	UNIT	DWG. N°	MOD.
S2 – POWER SUPPLY DC/DC Mod. 65 MWQ 515					P.Facoetti					11859	
					DATE 20-10-99	DATE	DATE	REPLACED BY	DRAWING TYPE Topographic	BOARD REFERENCE	SHEET / REV.

TECHNIX

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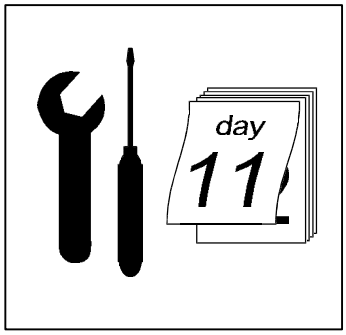
PRACTIX 100 PLUS

PROGRAMMED MAINTENANCE



[File: W3022_Rev0.doc]

NOTES

- It 's advisable to perform the unit programmed maintenance every 12 month as to the "Programmed Maintenance Sheet".
- Tools, instruments and all the diagnostic programs available on the unit are described in the Technical Manual chapt. "Service information" ".
- Checking and adjustment procedures are described in the Technical Manual chapt. "Installation & Acceptance" and "Adjustment".
- In case of wore parts replacement always use original spare parts. For this purpose refer to Technical Manual chapt. "Parts List".

PROGRAMMED MAINTENANCE SHEET

Unit: PRACTIX 100 plus	S/N:
Place of installation:	Date of installation:
Dept:	Date of maintenance:

General checks (sight checks)	
Warning and s/n labels presence check	❑ yes ❑ no
Cables and housings status check	❑ yes ❑ no
Monobloc oil leakage check	❑ yes ❑ no
Cover status check	❑ yes ❑ no
Screws presence general check	❑ yes ❑ no
Painting check	❑ yes ❑ no
Mechanical checks	
Arm parking position check (locking, unlocking, stability)	❑ yes ❑ no
Arm balancing and sliding check	❑ yes ❑ no
Monobloc-collimator balancing and rotation check	❑ yes ❑ no
Maneuverability and wheels check	❑ yes ❑ no
Brakes check	❑ yes ❑ no
Hanging parts proper fixing check (Monobloc, Collim.)	❑ yes ❑ no
Screws gripping general check	❑ yes ❑ no
Electrical checks	
Display and leds check	❑ yes ❑ no
Keys and buttons check	❑ yes ❑ no
Acoustic signals check	❑ yes ❑ no
Collimator lamp and timer check	❑ yes ❑ no
Anode rotation check	❑ yes ❑ no
X-ray checks	
Irradiated field check	❑ yes ❑ no
X-ray data check (accuracy)	❑ yes ❑ no
Electrical safety checks	
Ground protection resistance check	❑ yes ❑ no
Leaked current to the ground and into packing check	❑ yes ❑ no
Optionals check	
Dosimeter check	❑ yes ❑ no
Infra Red Remote Control check	❑ yes ❑ no

User's signature:	Technician's signature:

DOCUMENT STATUS

Rev.	*Date*	*Page/s*	*Modification description*
0			Document approval
1			
2			
3			
4			
5			